ANALOG

SCIENCE FICTION AND FACT

DECEMBER 2005

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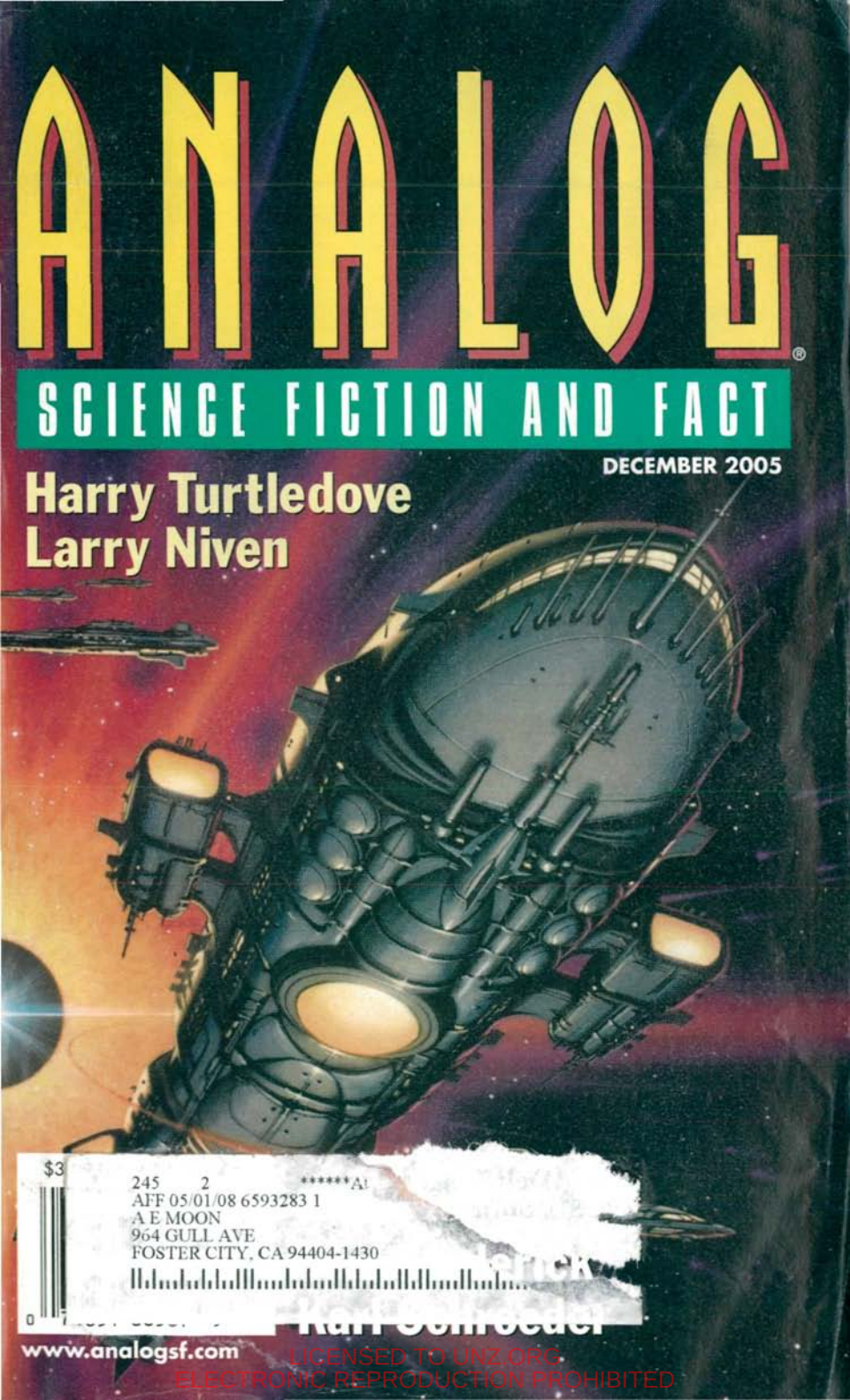

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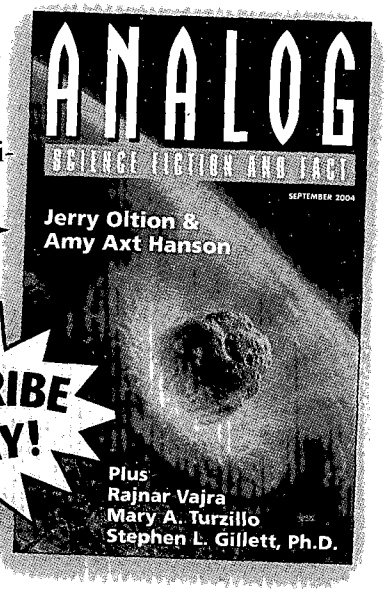

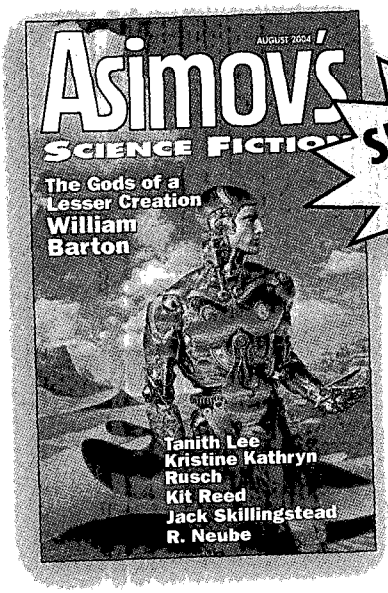

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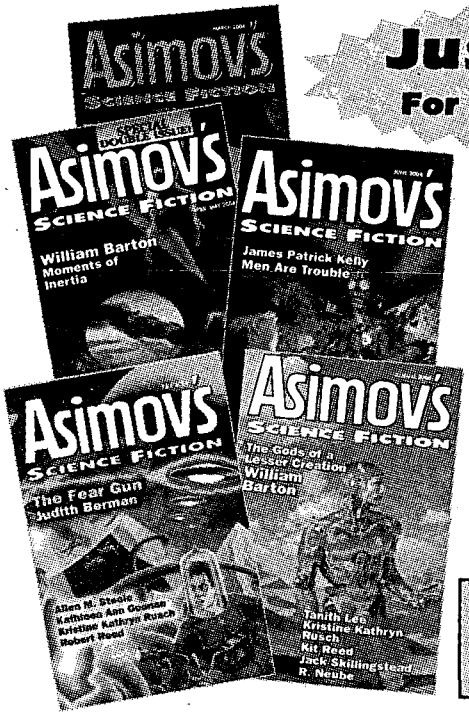

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SCIENCE FICTION AND FACT

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EDITORIAL Stanley Schmidt

NO POLITICS, PLEASE

Occasionally I get letters complaining that stories and articles in *Analog* have become "too political." Even though it doesn't happen often, it raises an important question that probably deserves periodic reexamination: just what is the proper role of politics in a science fiction magazine?

I must begin with a couple of wry observations. "Too much politics" seems to mean, with few if any exceptions, "too much politics different from mine." I can't recall ever getting a letter from anyone saying, "I'm a conservative and your magazine is too full of conservative propaganda" or "I'm a liberal and your magazine is too full of liberal propaganda." It's always "I'm a conservative and your magazine is too full of liberal propaganda" or "I'm a liberal and your magazine is too full of conservative propaganda." And we do get both—sometimes about the same story or article. Either accusation is pretty ridiculous, of course, when you consider, for example, the amount of emphasis our writers often place on individual responsibility (often regarded as a "conservative" trait) and also on individual rights and freedoms (often regarded as "liberal"). The fact is that we're not here to push any one ideology, but to explore a wide range of ideas and viewpoints, some of which can be considered political.

"Politics," of course, has at least two main categories of meanings. One is the real-world, real-time business of actively campaigning for or against specific politicians and policies. The other is the more abstract, general kind, dealing with principles of governing a society as they might apply at any time, present or future—what *The American Heritage Dictionary* defines as "The often internally conflicting interrelationships among people in a society" and *Webster's Third New International Dictionary* as "A branch of ethics concerned with the state or social organism as a whole rather than the individual person; a division of moral philosophy dealing with the ethical relations and duties of governments or other social organizations."

The first category, campaigning for policies and politicians, is almost always impractical and inappropriate for a magazine like *Analog*, and we almost never do it, if only because of lead time. Our production methods are necessarily geared to economy, not speed, and it takes a minimum of four or five months to get anything into print. If we tried to do up-to-the-minute commentary on truly current events, those events would usually be fairly old history and our comments rendered obsolete before they could be read. For that reason we almost never deal specifically with the hot topics of the moment, or name names, except as illustrations of more broadly applicable principles.

Yes, I know there are, rarely, apparent exceptions. To save you the trouble of writing to point them out, I will confess right up front that I did mention James Watt when he had just become Secre-

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tary of the Interior in the early '80s and was pushing irreversibly destructive environmental policies; and just a couple of years ago I advocated support of President Bush's reelection-year manned space initiative (or something like it) whether or not you agreed with his general political stance. In those particular instances, the issues involved had arisen in an early stage of a regime and were likely to remain relevant for even longer than our lead time—and, more important, they illustrated general considerations that would remain important long after Watt and Bush had passed into history. (Many of the comments in my "Watt" editorial, for instance, are again acutely pertinent as I write this 24 years later.)

The second kind of "politics" and "political" is and has long been one of the central concerns of science fiction—and will remain so for the foreseeable future. The *first* purpose of science fiction, the one to which all else is subordinate, is to entertain the readers; but there are lots of ways to do that. Certainly imagining interesting gadgets and worlds is an important part of the process, but most readers (or at least most *Analog* readers) now want that plus more. They want their thoughts provoked.

John W. Campbell, Jr., is commonly and justly credited with revolutionizing the field of science fiction when he took over the editorship of this magazine (then called *Astounding*) in the late 1930s. An important part of the way he did that was an increased emphasis on using *real* science in the stories, accurately extrapolating the implications of what was already known or imagining new kinds of science that might conceivably be discovered in the future without contradicting what was already known. Perhaps even more important was an increased emphasis on how discoveries and inventions might affect human lives, rather than on the mere novelty of the ideas themselves. Where an earlier writer might have been content to imagine the automobile before it existed, Campbell would want him to imagine the interstate expressway system, drive-in theaters, suburban sprawl and shopping malls, licensing systems and the insurance business.

You will note from that example that an important part of imagining how new science and technology affects human life involves such questions as how the consequences of inventions and discoveries should be regulated and funded, and how they might be used or abused by government itself. Readers complaining about our consideration of such questions as if it were new might benefit from a reminder that Campbell himself explicitly recognized them as an important concern of science fiction quite early. In his introduction to *The Astounding Science Fiction Anthology* (published in 1952 and still worth careful reading) he wrote:

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"Science fiction is the literature of the Technological Era. It, unlike other literatures, assumes that change is the natural order of things, that there are goals ahead larger than those we know. That the motto of the technical civilization is true: 'There must be a better way of doing this!'

"'This,' however, doesn't refer solely to gadgets and machines. Only in its early childhood did science fiction consider that facet solely, or even primarily. 'This' is a method of living together; a method of government, a method of thinking, or a method of human relations. Machines and gadgets aren't the end and the goal; they are the *means* to the true goal, which is a better way of living with each other and with ourselves."

Computers and the internet, for example, have already had a huge impact on how people live, do business, and interact at every level. (I recently attended the wedding of a niece who met her husband in an online chat room.) We can see, if only dimly, a multitude of ways that that pervasive influence is likely to grow even greater, not just by degrees, but by leaps and bounds. Surely it is the business of science fiction, and science fiction writers writing nonfiction about the subjects they consider in their stories, to try to imagine where those leaps might take us, whether exhilarating heights or bottomless pits. It is likewise the business of science fiction writers to consider, for example, how and whether future space programs should be financed and regulated, and how they should be divided between manned and unmanned programs. Or whether and how stem cell research and cloning, human or otherwise, should be done. And so on.

For that matter, even though psychology and sociology are (at least so far) less rigorously predictive than the "hard" sciences, they are surely areas in which we need and can hope to find answers. None of the many social or governmental systems tried by our species in the past has been perfect; why shouldn't science fiction writers try to imagine others that might serve us better in the future, and "try them out" on paper?

That's what authors try to do here; that's the meaning of *Analog* in our title. Campbell changed the name in 1960 in part because he thought *Astounding* sounded too sensational for what he and the authors were actually doing in its

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pages, and he wanted the new title to more accurately reflect the content. He thought of each story as an analog simulation of a possible future, a way to try out a way things might change and explore the likely consequences on paper *before* doing it in the real world, where real people might get hurt.

But how do writers decide which possibilities to explore? At least one person has said that all science fiction, no matter when and where it is ostensibly set, is really about the present—the world in which the writer is writing. I think that's too strong a statement; at least some futures are imagined not because of the author's *angst du jour,* but simply because someone, perhaps in a moment of whimsical thinking about "What if?," happened to think of a possibility with implications that would be fun to play with. But it's surely true that what's happening around writers, and what they care about, will often influence what kinds of problems they'll inflict on their characters, and what kinds of problems they'll ponder when they're writing nonfiction.

If many writers feel that the future is threatened by a dumbing-down of education by ultraliberal educators who think self-esteem is more important than competence, or the future of science by religious ultraconservatives who think they should redefine "science" for everybody, it is both unsurprising and reasonable that writers will explore the possible consequences of such trends. In the same way, it is natural that they explore the implications of new biology, whether they feel threatened by the "inhumanity" of cloning or the shortsightedness of narrow restrictions on stem-cell research. Or that some writers explore the dangers of withdrawing from space (as I did in "The Unreachable Stars," back in 1971), or of using new information technology to wield excessive government control—or failing to use it to keep terrorists in check.

Some will claim that there is no point in spending too much time or thought worrying about trends that look dangerous, because history is full of pendulum swings between extremes and most of these things will just be blips. Yes, it is, and most of them will—but some of them won't. Hitler's Germany was a pendulum that swung right off its mount. Why does that sometimes happen even though usually it doesn't? Well, you have to remember *why* the social pendulum swings. Basically (as I discussed at greater length in my editorial "Pendulums" in September 1985), it's the same reason a physical pendulum swings: when it's deflected from its equilibrium position, there's a restoring force that tries to pull it back. For a physical pendulum, the restoring force is provided by gravity as the bob is raised farther above its midpoint; for a mass on a spring, the restoring force comes from the elasticity of the spring, where the force required to stretch it a given distance is proportional to the distance. In each case, the bigger the deflection, the bigger the restoring force.

For the social pendulum, the restoring force comes from part of the population reacting against what they see as growing extremism by another part, and trying harder and harder to pull things back to normal. If nobody bothers to react because everyone just assumes that history is a series of pendulum swings, there's no restoring force and the pendulum *doesn't* swing. Instead, the current extremism grows out of control, possibly doing irreversible damage to the society. Those social pendulum swings don't occur spontaneously for no reason; they occur because part of the society provides a restoring force that gets stronger as things get farther from "normal." So it's *essential* that when people see what they think of as a dangerous trend, they react against it. As Edmund Burke said, "All that is necessary for the triumph of evil is that good men do nothing."

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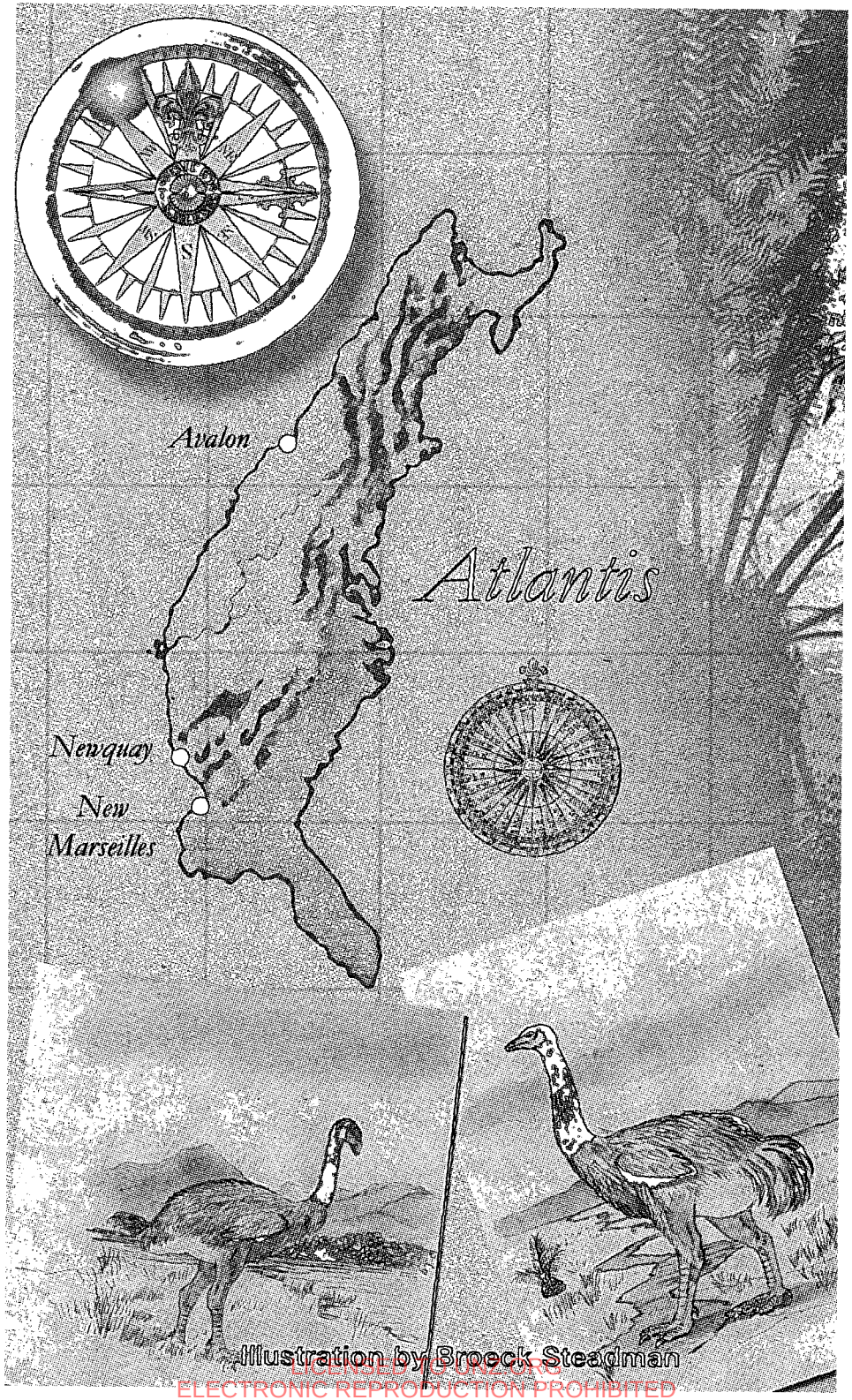

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We've developed definite ideas about what a person *should* do, but we, too, are products of our time. In the face of irresistable historical forces, a person must consider what he *can* do. . . .

AUDUBON IN ATLANTIS

Harvey Fruchtbove

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Delicate as if walking on eggs, the riverboat *Augustus Caesar* eased in alongside the quay at New Orleans. Colored roustabouts, bare to the waist, caught lines from the boat and made her fast. The steam whistle blew several long, happy blasts, telling the world the sternwheeler had arrived. Then black smoke stopped belching from the stacks as the crew shut down the engines.

The deck stopped quivering beneath John Audubon's feet. He breathed a silent sigh of relief; for all the time he'd spent aboard boats and ships, he was not a good sailor, and knew he never would be. Any motion, no matter how slight, could make his stomach betray him. He sighed—a long sea voyage still lay ahead of him.

Edward Harris came up and stood alongside him. "Well, my friend, we're on our way," he said.

"It's true—we are. And we shall do that which has not been done, while it may yet be done." As Audubon always did, he gathered enthusiasm when he thought about the goal and not the means by which he had to accomplish it. His English was fluent, but heavily flavored by the French that was his birth-speech. He was a good-sized man—about five feet ten—with shoulder-length gray hair combed straight back from his forehead and with bushy gray side whiskers that framed a long, strong-nosed face. Even without an accent, he would have spoken more mushily than he liked; he was nearer sixty than fifty, and had only a few teeth left. "Before long, Ed, either the great honkers will be gone from this world or I will."

He waited impatiently till the gangplank thudded into place, then hurried off the *Augustus Caesar* onto dry land, or something as close to dry land as New Orleans offered.

Men and women of every color, wearing everything from rags to frock coats and great hoop skirts, thronged the muddy, puddled street. Chatter, jokes, and English, and in every possible mixture and corruption of those tongues. Audubon heard far more English than he had when he first came to New Orleans half a lifetime earlier. It was a French town then, with the Spanish dons hanging on where and as they could. Times changed, though. He knew that too well.

Not far from the Cabildo stood the brick building that housed the Bartlett Line. Edward Harris following in his wake, Audubon went inside. A clerk nodded to them. "Good day, gentlemen," he said in English. A generation earlier, the greeting would surely have come in French. "How may I be of service to you today?"

"I wish to purchase passage to Atlantis for the two of us," Audubon replied.

"Certainly, sir." The clerk didn't bat an eye. "The *Maid of Orleans* sails for New Marseille and Avalon on the west coast in . . . let me see . . . five days. If you would rather wait another week, you can book places on the *Sea Queen* for the east. She puts in at St. Augustine, St. Denis, and Hanover, then continues on to London."

"We can reach the interior as easily from either coast," Harris said.

"Just so." Audubon nodded. "We would have to wait longer to leave for the east, the journey would be longer, and I would not care to set out from Hanover in any case. I have too many friends in the capital. With the kindest intentions in the world, they would sweep us up in their social whirl, and we should be weeks getting free of it. The *Maid of Orleans* it shall be."

"You won't be sorry, sir. She's a fine ship." The clerk spoke with professional enthusiasm. He took out a book of ticket forms and inked his pen. "In whose names shall I make these out?"

"I am John James Audubon," Audubon replied. "With me travels my friend and colleague, Mr. Edward Harris."

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"Audubon?" The clerk started to write, then looked up, his face aglow. "*The* Audubon? The artist? The naturalist?"

Audubon exchanged a secret smile with Edward Harris. Being recognized never failed to gratify him: he loved himself well enough to crave reminding that others loved him, too. When he swung back toward the clerk, he tried to make the smile modest. "I have the honor to be he, yes."

The clerk thrust out his hand. As Audubon shook it, the young man said, "I cannot tell you how pleased I am to make your acquaintance, sir. Mr. Hiram Bartlett, the chairman of the shipping line, is a subscriber to your *Birds and Viviparous Quadrupeds of Northern Terranova and Atlantis*—the double elephant folio edition. He sometimes brings in one volume or another for the edification of his staff. I admire your art and your text in almost equal measure, and that is the truth."

"You do me too much credit," Audubon said, in lieu of strutting and preening like a courting passenger pigeon. He was also glad to learn how prosperous Bartlett was. No one but a rich man could afford the volumes of the double elephant folio. They were big enough to show almost every bird and most beasts at life size, even if he had twisted poses and bent necks almost unnaturally here and there to fit creatures onto the pages' Procrustean bed.

"Are you traveling to Atlantis to continue your researches?" the clerk asked eagerly.

"If fate is kind, yes," Audubon replied. "Some of the creatures I hope to see are less readily found than they were in years gone by, while I"—he sighed—"I fear I am less well able to find them than I was in years gone by. Yet a man can do only what it is given to him to do, and I intend to try."

"If they're there, John, you'll find them," Harris said.

"God grant it be so," Audubon said. "What is the fare aboard the *Maid of Orleans*?"

"A first-class cabin for two, sir, is a hundred twenty livres," the clerk said. "A second-class cabin is eighty livres, while one in steerage is a mere thirty-five livres. But I fear I cannot recommend steerage for gentlemen of your quality. It lacks the comforts to which you will have become accustomed."

"I've lived rough. Once I get to Atlantis, I expect I shall live rough again," Audubon said. "But, unlike some gentlemen of the Protestant persuasion"—he fondly nudged Edward Harris—"I don't make the mistake of believing comfort is sinful. Let us travel first class."

"I don't believe comfort is sinful, and you know it," Harris said. "We want to get you where you're going and keep you as healthy and happy as we can while we're doing it. First class, by all means."

"First class it shall be, then." The clerk wrote up the tickets.

Audubon boarded the *Maid of Orleans* with a curious blend of anticipation and dread. The sidewheeler was as modern a steamship as any, but she was still a ship, one that would soon put to sea. Even going up the gangplank, his stomach gave a premonitory lurch.

He laughed and tried to make light of it, both to Harris and to himself. "When I think how many times I've put to sea in a sailing ship, at the mercy of wind and wave, I know how foolish I am to fret about a voyage like this," he said.

"You said it to the clerk last week: you can only do what you can do." Harris was blessed with both a calm stomach and a calm disposition. If opposites attracted, he and Audubon made a natural pair.

The purser strode up to them. Brass buttons gleamed on his blue wool coat; sweat gleamed on his face. "You gentlemen are traveling together?" he said. "If you would be kind enough to show me

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your tickets . . . ?"

"But of course," Audubon said. He and Harris produced them.

"I thank you." The purser checked them against a list he carried in one of his jacket's many pockets. "Mr. Audubon and Mr. Harris, is it? Very good. We have you in Cabin 12, the main deck on the starboard side. That's on the right as you look forward, if you haven't gone to sea before."

"I'm afraid I have," Audubon said. The purser took off his cap and scratched his balding crown, but Audubon meant it exactly as he'd phrased it. He nodded to Harris and to the free Negro pushing a wheeled cart that held their baggage. "Let's see what we've got, then."

They had a cabin with two beds, a chest of drawers, and a basin and pitcher on top of it: about what they would have had in an inn of reasonable quality, though smaller. *In an inn, though, I'm not likely to drown*, Audubon thought. He didn't suppose he was *likely* to drown on the *Maid of Orleans*, but if the seas got rough he would wish he were dead.

He gave the Negro half a livre, for the luggage, once unloaded from the cart, filled the cabin almost to the bursting point. Neither Audubon nor Harris was a dandy; they had no extraordinary amount of clothes. But Audubon's watercolors and paper filled up a couple of trunks, and the jars and the raw spirits they would use to preserve specimens took up a couple of more. And each of them had a shotgun for gathering specimens and a newfangled revolver for self-protection.

"Leave enough room so you'll be able to get out and come to the galley when you're hungry," the purser said helpfully.

"Thank you so much." Audubon hoped his sarcasm would freeze the man, but the purser, quite unfrozen, tipped his cap and left the cabin. Audubon muttered in pungent French.

"Never mind, John," Harris said. "We're here, and we'll weigh anchor soon. After that, no worries till we get to Avalon."

No worries for you. But Audubon kept that to himself. Harris couldn't help having a tranquil stomach, any more than the artist could help having a nervous one. Audubon only wished his were calm.

He also wished the *Maid of Orleans* sailed at the appointed hour, or even on the appointed day. *Thursday, the 6th day of April, 1843, at half past 10 in the morning*, the clerk had written on each ticket in a fine round hand. Audubon and Harris were aboard in good time. But half past ten came and went without departure. All of Thursday came and went. Passengers kept right on boarding. Stevedores kept on carrying sacks of sugar and rice into the ship's hold. Only the stuffed quail and artichokes and asparagus and the really excellent champagne in the first-class galley went some little way toward reconciling Audubon to being stuck on the steamship an extra day.

Finally, on Friday afternoon, the *Maid of Orleans'* engine rumbled to life. Its engine had a deeper, stronger note than the one that had propelled the *Augustus Caesar* down the Big Muddy. The deck thrummed under Audubon's shoes.

Officers bawled commands as smoke belched from the steamship's stacks. Sailors took in the lines that secured the ship to the quay. Others, grunting with effort, manned the capstan. One link at a time, they brought up the heavy chain and anchor that had held the sidewheeler in place.

Watching them, Harris said, "One of these days, steam will power the capstan as well as the paddlewheels."

"You could be right," Audubon replied. "The sailors must hope you are."

"Steam is the coming thing. You mark my words," Harris said. "Steamships, railroads, factories—who knows what else?"

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"So long as they don't make a steam-powered painter, I'll do well enough," Audubon said.

"A steam-powered painter? You come up with the maddest notions, John." Edward Harris laughed. Slowly, though, the mirth faded from his face. "With a mechanical pantograph, your notion might almost come true."

"I wasn't thinking of that so much," Audubon told him. "I was thinking of this new trick of light-writing people have started using the last few years. If it gave pictures in color, not shades of gray, and if you could make—no, they say *take*—a light-writing picture fast enough to capture motion . . . Well, if you could, painters would fall on thin times, I fear."

"Those are hefty *ifs*. It won't happen soon, if it ever does," Harris said.

"Oh, yes. I know." Audubon nodded. "I doubt I'll have to carry a hod in my fading years. My son will likely make a living as a painter, too. But you were talking about days to come. May I not think of them as well?"

The steamship's whistle screamed twice, warning that she was about to move away from the quay. Her paddle-wheels spun slowly in reverse, backing her out into the Big Muddy. Then one wheel stopped while the other continued to revolve. Along with the rudder, that swung the *Maid of Orleans'* bow downstream. Another blast from the whistle—a triumphant one—and more smoke pouring from her stacks, she started down the great river toward the Bay of Mexico. Though she hadn't yet reached the sea, Audubon's stomach flinched.

The Big Muddy's delta stretched far out into the Bay of Mexico. As soon as the *Maid of Orleans* left the river and got out into the bay, her motion changed. Her pitch and roll were nothing to speak of, not to the crew and not to most of the passengers. But they were enough to send Audubon and a few other unfortunates running for the rail. After a couple of minutes that seemed like forever, he wearily straightened, mouth foul and burning, eyes streaming with tears. He was rid of what ailed him, at least for the moment.

A steward with a tray of glasses nodded deferentially. "Some punch, sir, to help take the taste away?"

"*Merci. Mon Dieu, merci beaucoup*," Audubon said, tormented out of English.

"*Pas de quoi*," the steward replied. Any man on a ship sailing from New Orleans and touching in the southern parts of Atlantis had to speak some French.

Audubon sipped and let rum and sweetened lemon juice clean his mouth. When he swallowed, he feared he would have another spasm, but the punch stayed down. Reassuring warmth spread from his middle. Two more gulps emptied the glass. "God bless you!" he said.

"My pleasure, sir. We see some every time out." The steward offered restoratives to Audubon's fellow sufferers. They fell on him with glad cries. He even got a kiss from a nice-looking young woman—but only after she'd taken a good swig from her glass of punch.

Feeling human in a mournful way, Audubon walked up toward the bow. The breeze of the ship's passage helped him forget about his unhappy innards . . . for now. Gulls screeched overhead. A common tern dove into the sea, and came up with a fish in its beak. It didn't get to enjoy the meal. A herring gull flapped after it and made it spit out the fish before it could swallow. The gull got the dainty; the robbed tern flew off to try its luck somewhere else.

On the southern horizon lay the island of Nueva Galicia, about forty miles southeast of the delta. Only a little steam rose above Mount Isabella, near the center of the island. Audubon had been a young man the last time the volcano erupted. He remembered ash raining down on New Orleans.

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He looked east toward Mount Pensacola at the mouth of the bay. Pensacola had blown its stack more recently—only about ten years earlier, in fact. For now, though, no ominous plume of black rose in that direction. Audubon nodded to himself. He wouldn't have to worry about making the passage east during an eruption. When Mount Pensacola burst into flame, rivers of molten rock ran steaming into the sea, pushing the Terranovan coastline a little farther south and east. Ships couldn't come too close to observe the awe-inspiring spectacle, for the volcano threw stones to a distance coast artillery only dreamt of. Most splashed into the Bay of Mexico, of course, but who would ever forget the *Black Prince*, holed and sunk by a flying boulder the size of a cow back in '93?

The *Maid of Orleans* steamed sedately eastward. The waves weren't too bad; Audubon found that repeated doses of rum punch worked something not far from a miracle when it came to settling his stomach. If it did twinge now and again, the rum kept him from caring. And the lemon juice, he told himself, held scurvy at bay.

Mount Pensacola was smoking when the sidewheeler passed it near sunset. But the cloud of steam rising from the conical peak, like that above Mount Isabella, was thin and pale, not broad and black and threatening.

Edward Harris came up alongside Audubon by the port rail. "A pretty view," Harris remarked.

"It is indeed," Audubon said.

"I'm surprised not to find you sketching," Harris told him. "Sunset tinging the cloud above the mountain with pink against the deepening blue . . . What could be more picturesque?"

"Nothing, probably." Audubon laughed in some embarrassment. "But I've drunk enough of that splendid rum punch to make my right hand forget its cunning."

"I don't suppose I can blame you, not when *mal de mer* torments you so," Harris said. "I hope the sea will be calmer the next time you come this way."

"So do I—if there is a next time," Audubon said. "I am not young, Edward, and I grow no younger. I'm bound for Atlantis to do things and see things while I still may. The land changes year by year, and so do I. Neither of us will be again what we were."

Harris—calm, steady, dependable Harris—smiled and set a hand on his friend's shoulder. "You've drunk yourself sad, that's what you've done. There's more to you than to many a man half your age."

"Good of you to say so, though we both know it's not so, not any more. As for the rum . . ." Audubon shook his head. "I knew this might be my last voyage when I got on the *Augustus Caesar* in St. Louis. Growing up is a time of firsts, of beginnings."

"Oh, yes." Harris' smile grew broader. Audubon had a good idea which first he was remembering.

But the painter wasn't finished. "Growing up is a time for firsts, yes," he repeated. "Growing old . . . Growing old is a time for endings, for lasts. And I do fear this will be my last long voyage."

"Well, make the most of it if it is," Harris said. "Shall we repair to the galley? Turtle soup tonight, with a saddle of mutton to follow." He smacked his lips.

Harris certainly made the most of the supper. Despite his ballasting of rum, Audubon didn't. A few spoonfuls of soup, a halfhearted attack on the mutton and the roast potatoes accompanying it, and he felt full to the danger point. "We might as well have traveled second class, or even steerage," he said sadly. "The difference in cost lies mostly in the victuals, and I'll never get my money's worth at a table that rolls."

"I'll just have to do it for both of us, then." Harris poured brandy-spiked gravy over a second helping of mutton. His campaign with fork and knife was serious and methodical, and soon re-

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duced the mutton to nothing. He looked around hopefully. "I wonder what the sweet course is."

It was a cake baked in the shape of the *Maid of Orleans* and stuffed with nuts, candied fruit, and almond paste. Harris indulged immoderately. Audubon watched with a strange smile, half jealous, half wistful.

He went to bed not long after supper. The first day of a sea voyage always told on him, more than ever as he got older. The mattress was as comfortable as the one in the inn back in New Orleans. It might have been softer than the one he slept on at home. But it was unfamiliar, and so he tossed and turned for a while, trying to find the most comfortable position. Even as he tossed, he laughed at himself. Before long, he'd sleep wrapped in a blanket on bare ground in Atlantis. Would he twist and turn there, too? He nodded. Of course he would. Nodding still, he dozed off.

He hadn't been asleep long before Harris came in. His friend was humming "Pretty Black Eyes," a song popular in New Orleans as they set out. Audubon didn't think the other man even knew he was doing it. Harris got into his nightshirt, pissed in the chamber pot under his bed, blew out the oil lamp Audubon had left burning, and lay down. He was snoring in short order. Harris always denied that he snored—and why not? He never heard himself.

Audubon laughed once more. He tossed and twisted and yawned. Pretty soon, he was snoring again himself.

When he went out on deck the next morning, the *Maid of Orleans* might have been the only thing God ever made besides the sea. Terranova had vanished behind her; Atlantis still lay a thousand miles ahead. The steamship had entered the Hesperian Gulf, the wide arm of the North Atlantic that separated the enormous island and its smaller attendants from the continent to the west.

Audubon looked south and east. He'd been born on Santo Tomás, one of those lesser isles. He was brought to France three years later, and so escaped the convulsions that wracked the island when its colored slaves rose up against their masters in a war where neither side asked for quarter or gave it. Blacks ruled Santo Tomás to this day. Not many whites were left on the island. Audubon had only a few faded childhood memories of his first home. He'd never cared to go back, even if he could have without taking his life in his hands.

Edward Harris strolled out on deck. "Good morning," he said. "I hope you slept well?"

"Well enough, thanks," Audubon answered. *I would have done better without "Pretty Black Eyes," but such is life.* "Yourself?"

"Not bad, not bad." Harris eyed him. "You look . . . less greenish than you did yesterday. The bracing salt air, I suppose?"

"It could be. Or maybe I'm getting used to the motion." As soon as Audubon said that, as soon as he thought about his stomach, he gulped. He pointed an accusing finger at his friend. "There—you see? Just asking was enough to jinx me."

"Well, come have some breakfast, then. Nothing like a good mess of ham and eggs or something like that to get you ready for . . . Are you all right?"

"No," Audubon gasped, leaning out over the rail.

He breakfasted lightly, on toasted ship's biscuit and coffee and rum punch. He didn't usually start the day with strong spirits, but he didn't usually start the day with a bout of seasickness, either. *A good thing, too, or I'd have died years ago*, he thought. *I hope I would, anyhow.*

Beside him in the galley, Harris worked his way through fried eggs and ham and sausage and bacon and maize-meal mush. Blotting his lips with a snowy linen napkin, he said, "That was monstrous fine." He patted his pot belly.

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"So glad you enjoyed it," Audubon said tonelessly.

Once or twice over the next three days, the *Maid of Orleans* came close enough to another ship to make out her sails or the smoke rising from her stack. A pod of whales came up to blow nearby before sounding again. Most of the time, though, the sidewheeler might have been alone on the ocean.

Audubon was on deck again the third afternoon, when the sea—suddenly, as those things went—changed from greenish gray to a deeper, richer blue. He looked around for Harris, and spotted him not far away, drinking rum punch and chatting with a personable young woman whose curls were the color of fire.

"Edward!" Audubon said. "We've entered the Bay Stream!"

"Have we?" The news didn't seem to have the effect on Harris that Audubon wanted. His friend turned back to the redheaded woman—who also held a glass of punch—and said, "John is wild for nature in every way you can imagine." Spoken in a different tone of voice, it would have been a compliment. Maybe it still was. Audubon hoped he only imagined Harris' faintly condescending note.

"Is he?" The woman didn't seem much interested in Audubon one way or the other. "What about you, Eddie?"

Eddie? Audubon had trouble believing his ears. No one had ever called Harris such a thing in his hearing before. And Harris . . . smiled. "Well, Beth, I'll tell you—I am, too. But some parts of nature interest me more than others." He set his free hand on her arm. She smiled, too.

He was a widower. He could chase if that suited his fancy, not that Beth seemed to need much chasing. Audubon admired a pretty lady as much as anyone—more than most, for with his painter's eye he saw more than most—but was a thoroughly married man, and didn't slide from admiration to pursuit. He hoped Lucy was well.

Finding Harris temporarily distracted, Audubon went back to the rail himself. By then, the *Maid of Orleans* had left the cooler waters by the east coast of Terranova behind and fully entered the warm current coming up from the Bay of Mexico. Even the bits of seaweed floating in the ocean looked different now. Audubon's main zoological interests did center on birds and viviparous quadrupeds. All the same, he wished he would have thought to net up some of the floating algae in the cool water and then some of these so he could properly compare them.

He turned around to say as much to Harris, only to discover that his friend and Beth were no longer on deck. Had Harris gone off to pursue his own zoological interests? Well, more power to him if he had. Audubon looked back into the ocean, and was rewarded with the sight of a young sea turtle, not much bigger than the palm of his hand, delicately nibbling a strand of the new seaweed. Next to the rewards Harris might be finding, it didn't seem like much, but it was definitely better than nothing.

Like the Sun, Atlantis, for Audubon, rose in the east. That blur on the horizon—for a little while, you could wonder if it was a distant cloudbank, but only for a little while. Before long, it took on the unmistakable solidity of land. To the Breton and Galician fishermen who'd found it first, almost four hundred years before, it would have sent the setting sun to bed early.

"Next port of call is New Marseille, sir," the purser said, tipping his cap to Audubon as he went by.

"Yes, of course," the artist replied, "but I'm bound for Avalon."

"Even so, sir, you'll have to clear customs at the first port of call in Atlantis," the other man reminded him. "The States are fussy about these things. If you don't have a New Marseille customs stamp on your passport, they won't let

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you off the ship in Avalon."

"It's a nuisance, to open all my trunks for the sake of a stamp," Audubon said. The purser shrugged the shrug of a man with right, or at least regulations, on his side. And he told the truth: the United States of Atlantis *were* fussy about who visited them. *Do as we do*, they might have said, *or stay away*.

Not that coming ashore at New Marseille was a hardship. On the contrary. Warmed by the Bay Stream, the city basked in an almost unending May. Farther north, in Avalon, it seemed to be April most of the time. And then the Bay Stream curled north and east around the top of Atlantis and delivered the rest of its warmth to the north of France, to the British Isles, and to Scandinavia. The east coast of Atlantis, where the winds swept across several hundred miles of mountains and lowlands before they finally arrived, was an altogether darker, harsher place.

But Audubon was in New Marseille, and if it wasn't veritably May, it was the middle of April, which came close enough. A glance as he and Harris carted their cases to the customs shed sufficed to tell him he'd left Terranova behind. Oh, the magnolias that shaded some nearby streets weren't much different from the ones he could have found near New Orleans. But the ginkgoes on other thoroughfares . . . Only one other variety of ginkgo grew anyplace else in the world: in China. And the profusion of squat cycads with tufts of leaves sprouting from the tops of squat trunks also had few counterparts anywhere in the temperate zone.

The customs official, by contrast, seemed much like customs officials in every other kingdom and republic Audubon had ever visited. He frowned as he examined their declaration, and frowned even more as he opened up their baggage to confirm it. "You have a considerable quantity of spirits here," he said. "A dutiable quantity, in fact."

"They aren't intended for drinking or for resale, sir," Audubon said, "but for the preservation of scientific specimens."

"John Audubon's name and artistry are known throughout the civilized world," Edward Harris said.

"I've heard of the gentleman myself. I admire his work, what I've seen of it," the official replied. "But the law does not consider intent. It considers quantity. You will not tell me these strong spirits *cannot* be drunk?"

"No," Audubon admitted reluctantly.

"Well, then," the customs man said. "You owe the fisc of Atlantis . . . Let me see . . ." He checked a table thumbtacked to the wall behind him. "You owe twenty-two eagles and, ah, fourteen cents."

Fuming, Audubon paid. The customs official gave him a receipt, which he didn't want, and the requisite stamp in his passport, which he did. As he and Harris trundled their chattels back to the *Maid of Orleans*, a small bird flew past them. "Look, John!" Harris said. "Wasn't that a gray-throated green?"

Not even the sight of the Atlantean warbler could cheer Audubon. "Well, what if it was?" he said, still mourning the money he'd hoped he wouldn't have to spend.

His friend knew what ailed him. "When we get to Avalon, paint a portrait or two," Harris suggested. "You'll make it up, and more besides."

Audubon shook his head. "I don't *want* to do that, dammit." When thwarted, he could act petulant as a child. "I grudge the time I'd have to spend. Every moment counts. I have not so many days left myself, and the upland honkers. . . . Well, who can say if they have any left at all?"

"They'll be there." As usual, Harris radiated confidence.

"Will they?" Audubon, by contrast, careened from optimism to the slough of despond on no known schedule. At the moment, not least because of the customs man, he was mired in gloom.

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"When fishermen first found this land, a dozen species of honkers filled it: filled it as buffalo fill the plains of Terranova. Now . . . Now a few may be left in the wildest parts of Atlantis. Or, even as we speak, the last ones may be dying—may already have died!—under an eagle's claws or the jaws of a pack of wild dogs or to some rude trapper's shotgun."

"The buffalo are starting to go, too," Harris remarked.

That only agitated Audubon more. "I must hurry! Hurry, do you hear me?"

"Well, you can't go anywhere till the *Maid of Orleans* sails," Harris said reasonably.

"One day soon, a railroad will run from New Marseille to Avalon," Audubon said. Atlantis was building railroads almost as fast as England: faster than France, faster than any of the new Terranovan republics. But soon was not yet, and he *did* have to wait for the steamship to head north.

Passengers left the *Maid of Orleans*. Beth got off, which made Harris glum. Others came aboard. Longshoremen carried crates and boxes and barrels and bags ashore. Others brought fresh cargo onto the ship. Passengers and longshoremen alike moved too slowly to suit Audubon. Again, he could only fume and pace the mercifully motionless deck. At last, late the next afternoon, the *Maid of Orleans* steamed towards Avalon.

She stayed close to shore on the two-and-a-half-day journey. It was one of the most beautiful routes anywhere in the world. Titanic redwoods and sequoias grew almost down to the shore. They rose so tall and straight, they might almost have been the columns of a colossal outdoor cathedral.

But that cathedral could have been dedicated to puzzlement and confusion. The only trees like the enormous evergreens of Atlantis were those on the Pacific coast of Terranova, far, far away. Why did they thrive here, survive there, and exist nowhere else? Audubon had no more answer than any other naturalist, though he dearly wished for one. *That* would crown a career! He feared it was a crown he was unlikely to wear.

The *Maid of Orleans* passed a small fishing town called Newquay without stopping. Having identified the place on his map, Audubon was pleased when the purser confirmed he'd done it right. "If anything happens to the navigator, sir, I'm sure we'd be in good hands with you," the man said, and winked to show he didn't aim to be taken too seriously.

Audubon gave him a dutiful smile and went back to eyeing the map. Atlantis' west coast and the east coast of North Terranova a thousand miles away put him in mind of two pieces of a world-sized jigsaw puzzle: their outlines almost fit together. The same was true for the bulge of Brazil in South Terranova and the indentation in West Africa's coastline on the other side of the Atlantic. And the shape of Atlantis' eastern coast corresponded to that of western Europe in a more general way.

What did that mean? Audubon knew he was far from the first to wonder. How could anyone who looked at a map help but wonder? Had Atlantis and Terranova been joined once upon a time? Had Africa and Brazil? How could they have been, with so much sea between? He saw no way it could be possible. Neither did anyone else. But when you looked at the map . . .

"Coincidence," Harris said when he mentioned it at supper.

"Maybe so." Audubon cut meat from a goose drumstick. His stomach was behaving better these days—and the seas stayed mild. "But if it is a coincidence, don't you think it's a large one?"

"World's a large place." Harris paused to take a sip of wine. "It has room in it for a large coincidence or three, don't you think?"

"Maybe so," Audubon said again, "but when you look at the maps, it seems as if those matches ought to spring from reason, not happenstance."

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"Tell me how the ocean got in between them, then." Harris aimed a finger at him like a pistol barrel. "And if you say it was Noah's flood, I'll pick up that bottle of fine Bordeaux and clout you over the head with it."

"I wasn't going to say anything of the sort," Audubon replied. "Noah's flood may have washed over these lands, but I can't see how it could have washed them apart while still leaving their coastlines so much like each other."

"So it must be coincidence, then."

"I don't believe it *must* be anything, *mon vieux*," Audubon said. "I believe we don't know what it is—or, I admit, if it's anything at all. Maybe they will one day, but not now. For now, it's a puzzlement. We need puzzlements, don't you think?"

"For now, John, I need the gravy," Harris said. "Would you kindly pass it to me? Goes mighty well with the goose."

It did, too. Audubon poured some over the moist, dark meat on his plate before handing his friend the gravy boat. Harris wanted to ignore puzzlements when he could. Not Audubon. They reminded him not only of how much he—and everyone else—didn't know yet, but also of how much he—in particular—might still find out.

As much as I have time for, he thought, and took another bite of goose.

Avalon rose on six hills. The city fathers kept scouting for a seventh so they could compare their town to Rome, but there wasn't another bump to be found for miles around. The west-facing Bay of Avalon gave the city that bore its name perhaps the finest harbor in Atlantis. A century and a half before, the bay was a pirates' roost. The buccaneers swept out to plunder the Hesperian Gulf for most of a lifetime, till a British and Dutch fleet drove them back to their nest and then smoked them out of it.

City streets still remembered the swashbuckling past: Goldbeard Way, Valjean Avenue, Cutpurse Charlie Lane. But two Atlantean steam frigates patrolled the harbor. Fishing boats, bigger merchantmen—some steamers, other sailing ships—and liners like the *Maid of Orleans* moved in and out. The pirates might be remembered, but they were gone.

May it not be so with the honkers, Audubon thought as the *Maid of Orleans* tied up at a pier. *Please, God, let it not be so.* He crossed himself. He didn't know if the prayer would help, but it couldn't hurt, so he sent it up for whatever it might be worth.

Harris pointed to a man coming up the pier. "Isn't that Gordon Coates?"

"It certainly is." Audubon waved to the man who published his work in Atlantis. Coates, a short, round fellow with side whiskers even bushier than Audubon's, waved back. His suit was of shiny silk; a stovepipe hat sat at a jaunty angle on his head. Audubon cupped his hands in front of his mouth. "How are you, Gordon?"

"Oh, tolerable. Maybe a bit better than tolerable," Coates replied. "So you're haring off into the wilderness again, are you?" He was a city man to the tips of his manicured fingers. The only time he went out to the countryside was to take in a horse race. He knew his ponies, too. When he bet, he won . . . more often than not, anyhow.

He had a couple of servants waiting with carts to take charge of the travelers' baggage. He and Audubon and Harris clasped hands and clapped one another on the back when the gangplank went down and passengers could disembark. "Where are you putting us up?" asked Harris, who always thought about things like where he would be put up. Thanks to his thoughts about such things, Audubon had stayed in some places more comfortable than those where he might have if he made his own arrangements.

"How does the Hesperian Queen sound?" Coates answered.

"Like a pirate's kept woman,"

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Audubon answered, and the publisher sent up gales of laughter. Audubon went on, "Is it near a livery stable or a horse market? I'll want to get my animals as soon as I can." Harris let out a sigh. Audubon pretended not to hear it.

"Not too far, not too far," Coates said. Then he pointed up into the sky. "Look—an eagle! There's an omen for you, if you like."

The large, white-headed bird sailed off toward the south. Audubon knew it was likely bound for the city dump, to scavenge there. White-headed eagles had thrived since men came to Atlantis. Seeing this one secretly disappointed Audubon. He wished it were a red-crested eagle, the Atlantean national bird. But the mighty raptors—by all accounts, the largest in the world—had fallen into a steep decline along with the honkers, which were their principal prey.

"Well," he said, "the Hesperian Queen."

The last time he was in Avalon, the hotel had had another name and another owner. It had come up in the world since. So had Avalon, which was visibly bigger and visibly richer than it had been ten years—or was it twelve now?—before.

Harris noticed, too. Harris generally noticed things like that. "You do well for yourselves here," he told Gordon Coates over beefsteaks at supper.

"Not too bad, not too bad," the publisher said. "I'm about to put out a book by a chap who thinks he's written the great Atlantean novel, and he lives right here in town. I hope he's right. You never can tell."

"You don't believe it, though," Audubon said.

"Well, no," Coates admitted. "Everybody always thinks he's written the great Atlantean novel—unless he comes from Terranova or England. Sometimes even then. Mr. Hawthorne has a better chance than some—a better chance than most, I daresay—but not *that* much better."

"What's it called?" Harris asked.

"*The Crimson Brand*," Coates said. "Not a bad title, if I say so myself—and I do, because it's mine. *He* wanted to name it *The Shores of a Different Sea*." He yawned, as if to say authors were hopeless with titles. Then, pointing at Audubon, he *did* say it: "I'd have called your books something else, too, if they weren't also coming out in England and Terranova. *Birds and Critters*, maybe. Who remembers what a quadruped is, let alone a viviparous one?"

"They've done well enough with the name I gave them," Audubon said.

"Well enough, sure, but they might've done better. I could've made you *big*." Coates was a man with an eye for the main chance. Making Audubon *big*—he lingered lovingly over the word—would have made him money.

"I know why folks here don't know quadrupeds from a hole in the ground," Harris said. "Atlantis hardly had any before it got discovered. No snakes in Ireland, no . . . critters"—he grinned—"here, not then."

"No *viviparous* quadrupeds." Audubon had drunk enough wine to make him most precise—but not too much to keep him from pronouncing *viviparous*. "A very great plenty of lizards and turtles and frogs and toads and salamanders—and snakes, of course, though snakes lack four legs of quadrupedality." He was proud of himself for that.

"Sure enough, snakes haven't got a leg to stand on." Harris guffawed.

"Well, we have critters enough now, by God," Coates said. "Everything from mice on up to elk. Some of 'em we wanted, some we got anyway. Try and keep rats and mice from coming aboard ship. Yeah, go ahead and try. Good luck—you'll need it."

"How many indigenous Atlantean creatures are no more because of them?" Audubon said.

"Beats me," Coates answered. "Little too late to worry about it now, anyway,

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don't you think?"

"I hope not," Audubon said. "I hope it's not too late for them. I hope it's not too late for me." He took another sip of wine. "And I know the viviparous creature responsible for the greatest number of those sad demises here."

"Rats?" Coates asked.

"Weasels, I bet," Harris said.

Audubon shook his head at each of them in turn. He pointed an index finger at his own chest. "Man," he said.

He rode out of Avalon three days later. Part of the time he spent buying horses and tackle for them; that, he didn't begrudge. The rest he spent with Gordon Coates, meeting with subscribers and potential subscribers for his books; that, he did. He was a better businessman than most of his fellow artists, and normally wouldn't have resented keeping customers happy and trolling for new ones. If nobody bought your art, you had a devil of a time making more of it. As a younger man, he'd worked at several other trades, hated them all, and done well at none. He knew how lucky he was to make a living doing what he loved, and how much work went into what others called luck.

To his relief, he did escape without painting portraits. Even before he set out from New Orleans, he'd felt time's hot breath at his heels. He felt himself aging, getting weaker, getting feebler. In another few years, maybe even in another year or two, he would lack the strength and stamina for a journey into the wilds of central Atlantis. And even if he had it, he might not find any honkers left to paint.

I may not find any now, he thought. That ate at him like vitriol. He kept seeing a hunter or a lumberjack with a shotgun. . . .

Setting out from Avalon, Audubon might almost have traveled through the French or English countryside. Oh, the farms here were larger than they were in Europe, with more meadow between them. This was newly settled land; it hadn't been cultivated for centuries, sometimes for millennia. But the crops—wheat, barley, maize, potatoes—were either European or were Terranovan imports long familiar in the Old World. The fruit trees came from Europe; the nuts, again, from Europe and Terranova. Only a few stands of redwoods and Atlantean pines declared that the Hesperian Gulf lay just a few miles to the west.

It was the same with the animals. Dogs yapped outside of farmhouses. Chickens scratched. Cats prowled, hoping for either mice—also immigrants—or unwary chicks. Ducks and geese—ordinary domestic geese—paddled in ponds. Pigs rooted and wallowed. In the fields, cattle and sheep and horses grazed.

Most people probably wouldn't have noticed the ferns that sprouted here and there or the birds on the ground, in the trees, and on the wing. Some of those birds, like ravens, ranged all over the world. Others, such as the white-headed eagle Audubon had seen in Avalon, were common in both Atlantis and Terranova (on Atlantis' eastern coast, the white-tailed eagle sometimes visited from its more usual haunts in Europe and Iceland). Still others—no one knew how many—were unique to the great island.

No one but a specialist knew or cared how Atlantean gray-faced swifts differed from the chimney swifts of Terranova or little swifts from Europe. Many Atlantean thrushes were plainly the same sorts of birds as their equivalents to the west and to the east. They belonged to different species, but their plumages and habits were similar to those of the rest. The same held true for island warblers, which flitted through the trees after insects like their counterparts on the far side of the Hesperian Gulf. Yes, there were many similarities. But . . .

"I wonder how soon we'll start seeing oil thrushes," Audubon said.

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"Not this close to Avalon," Harris said. "Not with so many dogs and cats and pigs running around."

"I suppose not," Audubon said. "They're trusting things, and they haven't much chance of getting away."

Laughing, Harris mimed flapping his fingertips. Oil thrushes' wings were bigger than that, but not by much—they couldn't fly. The birds themselves were bigger than chickens. They used their long, pointed beaks to probe the ground for worms at depths ordinary thrushes, flying thrushes, couldn't hope to reach. When the hunting was good, they laid up fat against a rainy day.

But they were all but helpless against men and the beasts men had brought to Atlantis. It wasn't just that they were good eating, or that their fat, rendered down made a fine lamp oil. The real trouble was, they didn't seem to know enough to run away when a dog or a fox came after them. They weren't used to being hunted by animals that lived on the ground; the only viviparous quadrupeds on Atlantis before men arrived were bats.

"Even the bats here are peculiar," Audubon muttered.

"Well, so they are, but why do you say so?" Harris asked.

Audubon explained his train of thought. "Where else in the world do you have bats that spend more of their time scurrying around on the ground than flying?" he went on.

He thought that was a rhetorical question, but Harris said, "Aren't there also some in New Zealand?"

"Are there?" Audubon said in surprise. His friend nodded. The painter scratched at his side whiskers. "Well, well. Both lands far from any others, out in the middle of the sea . . ."

"New Zealand had its own honkers, too, or something like them," Harris said. "What the devil were they called?"

"Moas," Audubon said. "I do remember that. Didn't I show you the marvelous illustrations of their remains Professor Owen did recently? The draftsmanship is astonishing. Astonishing!" The way he kissed his bunched fingertips proved him a Frenchman at heart.

Edward Harris gave him a sly smile. "Surely you could do better?"

"I doubt it," Audubon said. "Each man to his own bent. Making a specimen look as if it were alive on the canvas—that I can do. My talent lies there, and I've spent almost forty years now learning the tricks and turns that go with it. Showing every detail of dead bone—I'm not in the least ashamed to yield the palm to the good professor there."

"If only you were a little less modest, you'd be perfect," Harris said.

"It could be," Audubon said complacently, and they rode on.

The slow, deep drumming came from thirty feet up a dying pine. Harris pointed. "There he is, John! D'you see him?"

"I'm not likely to miss him, not when he's the size of a raven," Audubon answered. Intent on grubs under the bark, the scarlet-cheeked woodpecker went on drumming. It was a male, which meant its crest was also scarlet. A female's crest would have been black, with a forward curl the male's lacked. That also held true for its close relatives on the Terranovan mainland, the ivory-bill and the imperial woodpecker of Mexico.

Audubon dismounted, loaded his shotgun, and approached the bird. He could get closer to the scarlet-cheeked woodpecker than he could have to one of its Terranovan cousins. Like the oil thrush, like so many other Atlantean birds, the woodpecker had trouble understanding that something walking along on the ground could endanger it. Ivory-bills and imperial woodpeckers were less naive.

The woodpecker raised its head and called. The sound was high and shrill, like a false note on a clarinet. Audubon paused with the gun on his shoulder, waiting to see if another bird would an-

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swer. When none did, he squeezed the trigger. The shotgun boomed, belching fireworks-smelling smoke.

With a startled squawk, the scarlet-cheeked woodpecker tumbled out of the pine. It thrashed on the ground for a couple of minutes, then lay still. "Nice shot," Harris said.

"*Merci*," Audubon answered absently.

He picked up the woodpecker. It was still warm in his hands, and still crawling with mites and bird lice. No one who didn't handle wild birds freshly dead thought of such things. He brushed his palm against his trouser leg to get rid of some of the vagrants. They didn't usually trouble people, who weren't to their taste, but every once in a while. . . .

A new thought struck him. He stared at the scarlet-cheeked woodpecker. "I wonder if the parasites on Atlantean birds are as different as the birds themselves, or if they share them with the birds of Terranova."

"I don't know," Harris said. "Do you want to pop some into spirits and see?"

After a moment, Audubon shook his head. "No, better to let someone who truly cares about such things take care of it. I'm after honkers, by God, not lice!"

"Nice specimen you took there, though," his friend said. "Scarlet-cheeks are getting scarce, too."

"Not so much forest for them to hunt in as there once was," Audubon said with a sigh. "Not so much of anything in Atlantis as there once was—except men and farms and sheeps." He knew that was wrong as soon as it came out of his mouth, but let it go. "If we don't show what it was, soon it will be no more, and then it will be too late to show. Too late already for too much of it." *Too late for me?* he wondered. *Please, let it not be so!*

"You going to sketch now?" Harris asked.

"If you don't mind. Birds are much easier to pose before they start to stiffen."

"Go ahead, go ahead." Harris slid down from his horse. "I'll smoke a pipe or two and wander around a bit with my shotgun. Maybe I'll bag something else you can paint, or maybe I'll shoot supper instead. Maybe both—who knows? If I remember right, these Atlantean ducks and geese eat as well as any other kind, except canvasbacks." He was convinced canvasback ducks, properly roasted and served with loaf sugar, were the finest fowl in the world. Audubon wasn't so sure he was wrong.

As Harris ambled away, Audubon set the scarlet-cheeked woodpecker on the grass and walked over to one of the pack horses. He knew which sack held his artistic supplies: his posing board and his wires, his charcoal sticks and precious paper.

He remembered how, as a boy, he'd despaired of ever portraying birds in realistic poses. A bird in the hand was all very well, but a dead bird looked like nothing but a dead bird. It drooped, it sagged, it cried its lifelessness to the eye.

When he studied painting with David in France, he sometimes did figure drawings from a mannequin. His cheeks heated when he recalled the articulated bird model he'd tried to make from wood and cork and wire. After endless effort, he produced something that might have done duty for a spavined dodo. His friends laughed at it. How could he get angry at them when he wanted to laugh at it, too? He ended up kicking the horrible thing to pieces.

If he hadn't thought of wires . . . He didn't know what he would have done then. Wires let him position his birds as if they were still alive. The first kingfisher he'd posed—he knew he was on to something even before he finished. As he set up the posing board now, a shadow of that old excitement glided through him again. Even the bird's eyes had seemed to take on life again once he posed it the way he wanted.

As he worked with wires now to position the woodpecker as it had clung to the tree trunk, he wished he could sum-

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mon more than a shadow of the old thrill. But he'd done the same sort of thing too many times. Routine fought against art. He wasn't discovering a miracle now. He was . . . working.

Well, if you're working, work the best you can, he told himself. And practice did pay. His hands knew almost without conscious thought how best to set the wires, to pose the bird. When his hands thought he was finished, he eyed the scarlet-cheeked woodpecker. Then he moved a wire to adjust its tail's position. It used those long, stiff feathers to brace itself against the bark, almost as if it had hind legs back there.

He began to sketch. He remembered the agonies of effort that went into his first tries, and how bad they were despite those agonies. He knew others who'd tried to paint, and who gave up when their earlier pieces failed to match what they wanted, what they expected. Some of them, from what he'd seen, had a real gift. But having it and honing it . . . Ah, what a difference! Not many were stubborn enough to keep doing the thing they wanted to do even when they couldn't do it very well. Audubon didn't know how many times he'd almost given up in despair. But when stubbornness met talent, great things could happen.

The charcoal seemed to have a life of its own as it moved across the page. Audubon nodded to himself. His line remained as strong and fluid as ever. He didn't have the tremors and shakes that marked so many men's descent into age—not yet. Yet how far away from them was he? Every time the Sun rose, he came one day closer. He sketched fast, racing against his own decay.

Harris' shotgun bellowed. Audubon's hand did jump then. Whose wouldn't, at the unexpected report? But that jerky line was easily rubbed out. He went on, quick and confident, and had the sketch very much the way he wanted it by the time Harris came back carrying a large dead bird by the feet.

"A turkey?" Audubon exclaimed.

His friend nodded, face wreathed in smiles. "Good eating tonight!"

"Well, yes," Audubon said. "But who would have thought the birds could spread so fast? They were introduced in the south . . . It can't be more than thirty years ago, can it? And now you shoot one here."

"They give better sport than oil thrushes and the like," Harris said. "At least they have the sense to get away if they see trouble coming. The sense God gave a goose, you might say—except He didn't give it to all the geese here, either."

"No," Audubon said. Some of Atlantis' geese flew to other lands as well, and were properly wary. Some stayed on the great island the whole year round. Those birds weren't. Some of them flew poorly. Some couldn't fly at all, having wings as small and useless as those of the oil thrush.

Honkers looked uncommonly like outsized geese with even more outsized legs. Some species even had black necks and white chin patches reminiscent of Canada geese. That frankly puzzled Audubon: it was as if God were repeating Himself in the Creation, but why? Honkers' feet had vestigial webs, too, while their bills, though laterally compressed, otherwise resembled the broad, flat beaks of ordinary geese.

Audubon had seen the specimens preserved in the museum in Hanover: skeletons, a few hides, enormous greenish eggs. The most recent hide was dated 1803. He wished he hadn't remembered that. If this was a wild goose chase, a wild honker chase . . . Then it was, that was all. He was doing all he could. He only wished he could have done it sooner. He'd tried. He'd failed. He only hoped some possibility of success remained.

Harris cleaned the turkey and got a fire going. Audubon finished the sketch. "That's a good one," Harris said, glancing over at it.

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"Not bad," Audubon allowed—he *had* caught the pose he wanted. He gutted the scarlet-cheeked woodpecker so he could preserve it. Not surprisingly, the bird's stomach was full of beetle larvae. The very name of its genus, *Campephilus*, meant *grub-loving*. He made a note in his diary and put the bird in strong spirits.

"Better than that," Harris said. He cut up the turkey and skewered drumsticks on twigs.

"Well, maybe," Audubon said as he took one of the skewers from his friend and started roasting the leg. He wasn't shy of praise—no, indeed. All the same, he went on, "I didn't come here for scarlet-cheeked woodpeckers. I came for honkers, by God."

"You take what you get." Harris turned his twig so the drumstick cooked evenly. "You take what you get, and you hope what you get is what you came for."

"Well, maybe," Audubon said again. He looked east, toward the still poorly explored heart of Atlantis. "But the harder you work, the likelier you are to get what you want. I hope I can still work hard enough. And"—he looked east once more—"I hope what I want is still there to get."

He and Harris stayed on the main highway for most of a week. The broad, well-trodden path let them travel faster than they could have on narrower, more winding roads. But when Audubon saw the Green Ridge Mountains rising over the eastern horizon, the temptation to leave the main road got too strong to resist.

"We don't want to go into the mountains anywhere near the highway," he declared. "We know no honkers live close to it, or people would have seen them, *n'est-ce pas?*"

"Stands to reason," Harris said loyally. He paused before adding, "I wouldn't mind another couple of days of halfway decent inns, though."

"When we come back with what we seek, the Hesperian Queen will be none too good," Audubon said. "But we go through adversity to seek our goal."

Harris sighed. "We sure do."

On the main highway, fruit trees and oaks and chestnuts and elms and maples thrived. They were all imports from Europe or from Terranova. Audubon and Harris hadn't gone far from the highway before Atlantean flora reasserted itself: ginkgoes and magnolias, cycads and pines, with ferns growing in profusion as an understory. Birdsongs, some familiar, others strange, doubled and redoubled as the travelers moved into less settled country. Atlantean birds seemed more comfortable with the trees they'd lived in for generations uncounted than with the brash newcomers men brought in.

Not all the newcomers clung to the road. Buttercups and poppies splashed the improbably green landscape with color. Atlantean bees buzzed around the flowers that had to be unfamiliar to them . . . or maybe those were European honeybees, carried to the new land in the midst of the sea to serve the plants men needed, wanted, or simply liked. Curious, Audubon stopped and waited by some poppies for a closer look at the insects. They were, without a doubt, honeybees. He noted the fact in his diary. It left him oddly disappointed but not surprised.

"In another hundred years," he said, climbing back onto his horse, "how much of the old Atlantis will be left? Any?"

"In another hundred years," Harries replied, "it won't matter to either of us, except from beyond the Pearly Gates."

"No, I suppose not." Audubon wondered if he had ten years left, or even five, let alone a hundred. "But it should matter to those who are young here. They throw away marvels without thinking of what they're doing. Wouldn't you like to see dodos preserved alive?" He

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tried not to recall his unfortunate bird model.

"Alive? Why, I can go to Hanover and hear them speechifying," Harris said. Audubon snorted. His friend waved a placating hand. "Let it go, John. Let it go. I take your point."

"I'm so glad," Audubon said with sardonic relish. "Perhaps the authorities here—your speechifying dodos—could set up parks to preserve some of what they have." He frowned. "Though how parks could keep out foxes and weasels and rats and windblown seeds, I confess I don't know. Still, it would make a start."

They slept on the grass that night. The throaty hoots of an Atlantean ground owl woke Audubon somewhere near midnight. He loaded his shotgun by the faint, bloody light of the campfire's embers, in case the bird came close enough for him to spot it. Ground owls were hen-sized, more or less. They could fly, but not well. They hunted frogs and lizards and the outsized katydids that scurried through the undergrowth here. Nothing hunted them—or rather, nothing had hunted them till foxes and wild dogs and men came to Atlantis. Like so many creatures here, they couldn't seem to imagine they might become prey. Abundant once, they were scarce these days.

This one's call got farther and farther away. Audubon thought about imitating it to lure the ground owl into range of his charge. In the end, he forbore. Blasting away in the middle of the night might frighten Harris into an apoplexy. And besides—Audubon yawned—he was still sleepy himself. He set down the shotgun, rolled himself in his blanket once more, and soon started snoring again.

When Audubon woke the next morning, he saw a mouse-sized katydid's head and a couple of greenish brown legs only a yard or so from his bedroll. He swore softly: the ground owl *had* come by, but without hooting, so he never knew. If he'd stayed up . . . *If I'd stayed up, I would be useless today*, he thought. He needed regular doses of sleep much more than he had twenty years earlier.

"I wouldn't have minded if you fired on an owl," Harris said as he built up the fire and got coffee going. "We're here for that kind of business."

"Good of you to say so," Audubon replied. "It could be that I will have other chances."

"And it could be that you won't. You were the one who said the old Atlantis was going under. Grab with both hands while it's here."

"With the honkers, I intend to," Audubon said. "If they're there to be grabbed, grab them I shall. The ground owl . . . Well, who knows if it would have come when I hooted?"

"I bet it would. I never knew a soul who could call birds better than you." Harris took a couple of squares of hardtack out of an oilcloth valise and handed one to Audubon. The artist waited till he had his tin cup of coffee before breakfasting. He broke his hardtack into chunks and dunked each one before eating it. The crackers were baked to a fare-thee-well so they would keep for a long time, which left them chewier than his remaining teeth could easily cope with.

As he and his friend got ready to ride on, he looked again at the remains of the giant katydid. "I really ought to get some specimens of those," he remarked.

"Why, in heaven's name?" Harris said. "They aren't birds, and they aren't viviparous quadrupeds, either. They aren't quadrupeds at all."

"No," Audubon said slowly, "but doesn't it seem to you that here they fill the role mice play in most of the world?"

"Next time I see me a six-legged chirping mouse with feelers"—Harris wiggled his forefingers above his eyes—"you can lock me up and lose the key, on account of I'll have soused my brains

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with the demon rum."

"Or with whiskey, or gin, or whatever else you can get your hands on," Audubon said. Harris grinned and nodded. As Audubon saddled his horse, he couldn't stop thinking about Atlantean katydids and mice. *Something* had to scurry through the leaves and eat whatever it could find there, and so many other creatures ate mice . . . or, here, the insects instead. He nodded to himself. That was worth a note in the diary whenever they stopped again.

They rode into a hamlet a little before noon. It boasted a saloon, a church, and a few houses. BIDEFORD HOUSE OF UNIVERSAL DEVOTION, the church declared. Strange Protestant sects flourished in Atlantis, not least because none was strong enough to dominate—and neither was his own Catholic Church.

But the saloon, in its own way, was also a house of universal devotion. Bideford couldn't have held more than fifty people, but at least a dozen men sat in there, drinking and eating and talking. A silence fell when Audubon and Harris walked in. The locals stared at them. "Strangers," somebody said; he couldn't have sounded much more surprised had he announced a pair of kangaroos.

Not surprisingly, the man behind the bar recovered fastest. "What'll it be, gents?" he asked.

Harris was seldom at a loss when it came to his personal comforts. "Ham sandwich and a mug of beer, if you please."

"That sounds good," Audubon said. "The same for me, if you'd be so kind."

"Half an eagle for both of you together," the proprietor said. Some of the regulars grinned. Even without those telltale smiles, Audubon would have known he was being gouged. But he paid without complaint. He could afford it, and he'd be asking questions later on, and priming the pump with more silver. He wanted the locals to see he could be openhanded.

The beer was . . . beer. The sandwiches, by contrast, were prodigies: great slabs of tender, flavorful ham on fresh-baked bread, enlivened by spicy mustard and pickles all but jumping with dill and garlic and something else, something earthy—an Atlantean spice?

Audubon hadn't come close to finishing his—he had to chew slowly—when the man behind the bar said, "Don't see too many strangers here." Several locals—big, stocky, bearded fellows in homespun—nodded. So did Audubon, politely. The tapman went on, "Mind if I ask what you're doing passing through?"

"I am John James Audubon," Audubon said, and waited to see if anyone knew his name. Most places, he would have had no doubt. In Bideford . . . Well, who could say?

"The painter fella," one of the regulars said.

"That's right." Audubon smiled, more relieved than he wanted to show. "The painter fella." He repeated the words even though they grated. If the locals understood he was a prominent person, they were less likely to rob him and Harris for the fun of it. He introduced his friend.

"Well, what are you doing here in Bideford?" the proprietor asked again.

"Passing through, as you said," Audubon replied. "I'm hoping to paint honkers." This country was almost isolated enough to give him hope of finding some here—not quite, but almost.

"Honkers?" Two or three men said it as the same time. A heartbeat later, they all laughed. One said, "Ain't seen any of them big fowl round these parts since Hector was a pup."

"That's right," someone else said. Solemn nods filled the saloon.

"It's a shame, too," another man said. "My granddad used to say they was easy to kill, and right good eatin'. Lots of meat on 'em, too." That had to be *why* no honkers lived near Bideford these days, but the local seemed ignorant of cause and effect.

"If you know of any place where they

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might dwell, I'd be pleased to pay for the information." Audubon tapped a pouch on his belt. Coins clinked sweetly. "You'd help my work, and you'd advance the cause of science."

"Half now," the practical Harris added, "and half on the way back if we find what we're looking for. Maybe a bonus, too, if the tip's good enough."

A nice ploy, Audubon thought. *I have to remember that one*. The locals put their heads together. One of the older men, his beard streaked with gray, spoke up: "Well, I don't know anything for sure, mind, but I was out hunting a few years back and ran into this fellow from Thetford." *He* knew where Thetford was, but Audubon didn't. A few questions established that it lay to the northeast. The Bideford man continued, "We got to gabbing, and he said he saw some a few years before that, off the other side of his town. Can't swear he wasn't lyin', mind, but he sounded like he knew what he was talking about."

Harris looked a question towards Audubon. The artist nodded. Harris gave the Bideford man a silver eagle. "Let me have your name, sir," Harris said. "If the tip proves good, and if we don't pass this way again on our return journey, we *will* make good on the rest of the reward."

"Much obliged, sir," the man said. "I'm Lehonti Kent." He carefully spelled it out for Harris, who wrote it down in one of his notebooks.

"What can you tell me about the House of Universal Devotion?" Audubon asked.

That got him more than he'd bargained for. Suddenly everyone, even the most standoffish locals, wanted to talk at once. He gathered that the church preached the innate divinity of every human being and the possibility of transcending mere mankind—as long as you followed the preachings of the man the locals called the Reverend, with a very audible capital R. *Universal Devotion to the Reverend*, he thought. It all seemed to him the rankest, blackest heresy, but the men of Bideford swore by it.

"Plenty of Devotees"—another obvious capital letter—"in Thetford and other places like that," Lehonti Kent said. He plainly had only the vaguest idea of places more than a couple of days' travel from his home village.

"Isn't that interesting?" Audubon said: one of the few phrases polite almost anywhere.

Because the Bidefordites wanted to preach to them, he and Harris couldn't get away from the saloon for a couple of hours. "Well, well," Harris said as they rode away. "Wasn't that *interesting*?" He freighted the word with enough sarcasm to sink a ship twice the size of the *Maid of Orleans*.

Audubon's head was still spinning. The Reverend seemed to have invented a whole new prehistory for Atlantis and Terranova, one that had little to do with anything Audubon thought he'd learned. He wondered if he'd be able to keep it straight enough to get it down in his diary. The Devotees seemed nearly as superstitious to him as the wild red Terranovan tribes—and they should have known better, while the savages were honestly ignorant. Even so, he said, "If Lehonti—what a name!—Kent gave us a true lead, I don't mind the time we spent . . . too much."

Thetford proved a bigger village than Bideford. It also boasted a House of Universal Devotion, though it had a Methodist church as well. A crudely painted sign in front of the House said, THE REVEREND PREACHES SUNDAY!! Two exclamation points would have warned Audubon away even if he'd never passed through Bideford.

He did ask after honkers in Thetford. No one with whom he talked claimed to have seen one, but a couple of men did say some people from the town had seen them once upon a time. Harris doled out more silver, but it spurred neither memory nor imagination.

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"Well, we would have come this way anyhow," Audubon said as they went on riding northeast. The Green Ridge Mountains climbed higher in the sky now, dominating the eastern horizon. Peering ahead with a spyglass, Audubon saw countless dark valleys half hidden by the pines and cycads that gave the mountains their name. Anything could live there . . . couldn't it? He had to believe it could. "We have a little more hope now," he added, as much to himself as to Harris.

"Hope is good," his friend said. "Honkers would be better."

The words were hardly out of his mouth before the ferns and cycads by the side of the road quivered . . . and a stag bounded across. Audubon started to raise his shotgun, but stopped with the motion not even well begun. For one thing, the beast was gone. For another, the gun was charged with birdshot, which would only have stung it.

"*Sic transit gloria honkeris*," Harris said.

"*Honkeris?*" But Audubon held up a hand before Harris could speak. "Yes, *honker* would be a third-declension noun, wouldn't it?"

Little by little, the country rose toward the mountains. Cycads thinned out in the woods; more varieties of pines and spruces and redwoods took their places. The ferns in the undergrowth seemed different, too. As settlements thinned out, so did splashes of color from exotic flowers. The very air seemed different: mistier, moister, full of curious, spicy scents the nose would not meet anywhere else in the world. It felt as if the smells of another time were wafting past the travelers.

"And so they are," Audubon said when that thought crossed his mind. "This is the air of Atlantis as it was, Atlantis before those fishermen saw its coast loom up out of the sea."

"Well, almost," Harris said. That he and Audubon and their horses were here proved his point. In case it didn't, he pointed to the track down which they rode. The ground was damp—muddy in spots—for it had rained the day before. A fox's pads showed plainly.

"How many birds has that beast eaten?" Audubon said. "How many ground-dwellers' nests has it robbed?" Many Atlantean birds nested on the ground, far more than in either Europe or Terranova. But for a few snakes and large lizards, there were no terrestrial predators—or hadn't been, before men brought them in. Audubon made another note in his diary. Till now, he hadn't thought about the effect the presence or absence of predators might have on birds' nesting habits.

Even here, in the sparsely settled heart of Atlantis, a great deal had been lost. But much still remained. Birdsongs filled the air, especially just after sunrise when Audubon and Harris started out each day. Atlantis had several species of crossbills and grosbeaks: birds with bills that seemed made for getting seeds out of cones and disposing of them afterwards. As with so many birds on the island, they were closely related to Terranovan forms, but not identical to them.

Audubon shot a male green grosbeak in full breeding plumage. Lying in his hand, the bird, with its apple-green back, warm cinnamon belly, and yellow eye streak, seemed gaudy as a seventeenth-century French courtier. But on the branch of a redwood, against the green foliage and rusty-brown bark, it hadn't been easy to spot. If it weren't singing so insistently, chances were he would have ridden right past it.

At dusk, Harris shot an oil thrush. That wasn't for research, though Audubon did save the skin. The long-billed flightless thrush had more than enough meat for both of them. The flavor put Audubon in mind of snipe or woodcock: not surprising, perhaps, when all three were so fond of earthworms.

Gnawing on a thighbone, Harris said, "I wonder how long these birds will

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last."

"Longer than honkers, anyhow, because they're less conspicuous," Audubon said, and his friend nodded. He went on, "But you have reason—they're in danger. They're one more kind that nests on the ground, and how can they escape foxes and dogs that hunt by scent?"

Somewhere off in the distance, far beyond the light of the campfire, a fox yelped and yowled. Harris nodded. "There's a noise that wasn't heard here before the English brought them."

"If it weren't foxes, it would be dogs," Audubon said sadly, and Harris' head bobbed up and down once more. Atlantis was vulnerable to man and his creatures, and that was the long and short of it. "A pity. A great pity," Audubon murmured. Harris nodded yet again.

The screech ripped across the morning air. Audubon's horse snorted and tried to rear. He calmed it with hands and voice and educated thighs. "Good God!" Harris said. "What was that?"

Before answering, Audubon listened to the sudden and absolute silence all around. A moment before, the birds were singing their hearts out. As a lion's roar was said to bring stillness to the African plains, so this screech froze the forests of Atlantis.

It rang out again, wild and harsh and fierce. Excitement tingled through Audubon. "I know what it is!" Despite the urgency in his voice, it hardly rose above a whisper. His gaze swung to the shotgun. *Have to charge it with stronger shot*, he thought.

"What?" Harris also whispered, hoarsely. As after a lion's roar, talking out loud seemed dangerous.

"A red-crested eagle, by all the saints!" Audubon said. "A *rara avis* itself, and also, with luck, a sign honkers aren't far away." Maybe the Atlantean national bird was reduced to hunting sheep or deer, but Audubon hadn't seen any close by. If the eagle still sought the prey it had always chosen before the coming of man . . . Oh, if it did!

Harris didn't just look at his shotgun. He reached for it and methodically began to load. After a moment, so did Audubon. Red-crested eagles didn't fear men. They were used to swooping down on tall creatures that walked on two legs. People could die—people had died—under their great, tearing claws, long as a big man's thumb. Nor were their fierce beaks to be despised—anything but.

"Where did the cry come from?" Audubon asked after loading both barrels.

"That way." Harris pointed north. "Not far, either."

"No, not far at all," Audubon agreed. "We have to find it. We *have* to, Edward!" He plunged into the undergrowth, moving quiet as he could. Harris hurried after him. They both carried their shotguns at high port, ready to fire and ready to try to fend off the eagle if it struck before they could.

Call again. Audubon willed the thought toward the red-crested eagle with all his strength. *Call again. Show us where you are.*

And the eagle did. The smaller birds had begun to sing again. Silence came down on them like a heavy boot. Audubon grew acutely aware of how loud his own footfalls were. He tried to stride more lightly, with what success he had trouble judging. Tracking the cry, he swung to the west just a little.

"There!" Harris breathed behind him. His friend pointed and froze, for all the world like a well-bred, well-trained hunting dog.

Audubon's eyes darted this way and that. He did not see. . . . He did not see. . . . And then he did. "Oh," he whispered: more a soft sound of wonder than a word.

The eagle perched near the top of a ginkgo tree. It was a big female, close to four feet long from the end of its low,

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long bill to the tip of the tail. The crest was up, showing the bird was alert and in good spirits. It was the coppery red of a redheaded man's hair or a red-tailed hawk's tail, not the glowing crimson of a hummingbird's gorget. The eagle's back was dark brown, its belly a tawny buff.

Slowly, carefully, Audubon and Harris drew closer. For all their caution, the bird saw them. It mantled on its perch, spreading its wings and screeching again. The span was relatively small for the eagle's size—not much more than seven feet—but the wings were very broad. Red-crested eagles flapped more than they soared, unlike their white-headed and golden cousins. Naturalists disagreed about which were their closer kin.

"Watch out," Harris whispered. "It's going to fly."

And it did, not three heartbeats after the words left his mouth. Audubon and Harris both swung up their guns and fired at essentially the same instant. The eagle cried out once more, this time a startled squall of pain and fear. It fell out of the sky and hit the ground with a thump.

"Got it!" Harris exulted.

"Yes." Joy and sorrow warred in Audubon. That magnificent creature—a shame it had to perish for the sake of art and science. How many were left to carry on the race? One fewer, whatever the answer was.

This one wasn't dead yet. It thrashed in the ferns, screaming in fury because it couldn't fly. Its legs were long and strong—could it run? Audubon trotted towards it. *It mustn't get away,* he thought. Now that he and Harris had shot it, it had to become a specimen and a subject for his art. If it didn't, they would have knocked it down for nothing, and he couldn't bear the idea.

The red-crested eagle wasn't running. When he came close enough, he saw that a shotgun ball from one of the two charges had broken its left leg. The bird screeched and snapped at him; he had to jump back in a hurry to keep that fearsome beak from carving a chunk out of his calf. Hate and rage blazed in those great golden eyes.

Along with the shotgun, Harris also carried his revolver. He drew it now, and aimed it at the bird. "I'll finish it," he said. "Put it out of its misery." He thumbed back the hammer.

"In the breast, if you please," Audubon said. "I don't want to spoil the head."

"At your service, John. If the poor creature will only hold still for a few seconds . . ."

After more frantic thrashing and another long-neck lunge at the men who'd reduced it from lord of the air to wounded victim, the eagle paused to pant and to gather its waning strength. Harris fired. A pistol ball would have blown a songbird to pieces, but the eagle was big enough to absorb the bullet. It let out a final bubbling scream before slumping over, dead.

"That is one splendid creature," Harris said solemnly. "No wonder the Atlanteans put it on their flag and on their money."

"No wonder at all," Audubon said. He waited a few minutes, lest the eagle, like a serpent, have one more bite in it. Even then, he nudged the bird with a stick before picking it up. That beak, and the talons on the unwounded leg, commanded respect. He grunted in surprise as he straightened with the still-warm body in his arms. "How much would you say this bird weighs, Edward?"

"Let me see." Harris held out his arms. Audubon put the red-crested eagle in them. Harris grunted, too. He hefted the eagle, his lips pursed thoughtfully. "Dog my cats if it doesn't go thirty pounds, easy. You wouldn't think such a big bird'd be able to get off the ground, would you?"

"We saw it. Many have seen it," Audubon said. He took the eagle back from Harris and gauged its weight again

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himself. "Thirty pounds? Yes, that seems about right. I would have guessed something around there, too. Neither the golden nor the white-headed eagle goes much above twelve pounds, and even the largest African eagle will not greatly surpass twenty."

"Those birds don't hunt honkers," Harris said. His usual blunt good sense got to the nub of the problem in a handful of words. "The red-crested, now, it needs all the muscles it can get."

"No doubt you're right," Audubon said. "The biggest honkers, down in the eastern lowlands, would stand a foot, two feet, taller than a man and weigh . . . What do you suppose they would weigh?"

"Three or four times as much as a man, maybe more," Harris said. "You look at those skeletons, you see right away they were lardbutted birds."

Audubon wouldn't have put it that way, but he couldn't say his companion was wrong. "Can you imagine the red-crested eagle diving down to strike a great honker?" he said, excitement at the thought making his voice rise. "It would have been like Jove's lightning from the sky, nothing less."

"Can you imagine trying to hold them off with pikes and matchlocks and bows, the way the first settlers did?" Harris said. "Better those fellows than me, by God! It's a wonder there were any second settlers after that."

"No doubt that's so," Audubon said, but he was only half listening. He looked down at the red-crested eagle, already trying to decide how to pose it for what would, for all sorts of reasons, undoubtedly prove the last volume of *Birds and Viviparous Quadrupeds of Northern Terranova and Atlantis*. He wanted to show it in a posture that displayed its power and majesty, but the bird was simply too large even for the double elephant folios of his life's work.

What can't be cured . . ., he thought, and carried the bird back to the patiently waiting horses. Yes, it surely weighed every ounce of thirty pounds; sweat streamed down his face by the time he got to them. The horses rolled their eyes. One of them let out a soft snort at the smell of blood.

"There, there, my pets, my lovelies," he crooned, and gave each beast a bit of loaf sugar. That calmed them nicely; horses were as susceptible to bribery as people—and much less likely to go back on any bargain they made.

He got to work with the posing board—which, though he'd brought the largest one he had, was almost too small for the purpose—and his wires. Watching him, Harris asked, "How will you pose a honker if we find one?"

"*When* we find one." Audubon would not admit the possibility of failure to his friend or to himself. "How? I'll do the best I can, of course, and I trust I will enjoy your excellent assistance?"

"I'll do whatever you want me to. You know that," Harris said. "Would I be out here in the middle of nowhere if I wouldn't?"

"No, certainly not." Again, though, Audubon gave the reply only half his attention. He knew what he wanted to do now. He shaped the red-crested eagle with wings pulled back and up to brake its flight, talons splayed wide, and beak agape as if it were about to descend on a great honker's back.

He found a stick of charcoal and began to sketch. No sooner had the charcoal touched the paper than he knew this would be a good one, even a great one. Sometimes the hand would refuse to realize what the eye saw, what the brain thought, what the heart desired. Audubon always did the best he could, as he'd told Harris. Some days, that best was better than others. Today . . . Today was one of those. He felt almost as if he stood outside himself, watching himself perform, watching *something* perform through him.

When the drawing was done, he went on holding the charcoal stick, as if he didn't want to let it go. And he didn't.

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But he had nothing left to add. He'd done what he could do, and. . . .

"That's some of your best work in a long time, John—much better than the woodpecker, and that was mighty good," Harris said. "I didn't want to talk while you were at it, for fear I'd break the spell. But that one, when you paint it, will live forever. It will be less than life-sized on the page, then?"

"Yes. It will have to be," Audubon said. When he spoke, it also felt like breaking the spell. But he made himself nod and respond as a man would in normal circumstances; you couldn't stay on that exalted plane forever. Even touching it now and again seemed a special gift from God. More words came: "This is *right*. If it's small, then it's small, that's all. Those who see will understand."

"When they see the bird like that, they will." Harris seemed unable to tear his eyes away form the sketch.

And Audubon descended to mundane reality, drawing ginkgoes and pines and ferns for the background of the painting yet to come. The work there was solid, professional draftsmanship; it seemed a million miles away from the inspiration that had fired him only minutes before.

Once he finished all the sketches he needed, he skinned the eagle and dissected it. When he opened the bird's stomach, he found gobbets of half-digested, unusually dark flesh. It had a strong odor that put him in mind of. . . . "Edward!" he said. "What does this smell like to you?"

Harris stooped beside him and sniffed. He needed only a few seconds to find an answer, one very much in character:

"Steak-and-kidney pie, by God!"

And not only was the answer in character. It was also right, as Audubon recognized at once. "It does!" he exclaimed, though the homely dish wasn't one of his favorites. "And these bits of flesh have the look of kidney, too. And that means . . ."

"What?" Harris asked.

"From everything I've read, honker kidneys and the fat above them were—*are*—the red-crested eagle's favorite food!" Audubon answered. "If this bird has a belly full of chunks of kidney, then somewhere not far away, somewhere not far away at all, there must be—there *must* be, I say—honkers on which it fed."

"Unless it killed a deer or some such," Harris said. In that moment, Audubon almost hated his friend—not because Harris was wrong, but because he might not be. And dropping a brute fact on Audubon's glittering tower of speculation seemed one of the cruelest things any man could do.

"Well," Audubon said, and then, bucking up, "Well," again. He gathered himself, gathered his stubbornness. "We just have to find out, don't we?"

Two days later, two days deeper into the western foothills of the Green Ridge Mountains, Audubon's sense of smell again came to his aid. This time, he had no trouble identifying the odor a breeze sent his way. "Phew!" he said, wrinkling his nose. "Something's dead."

"Sure is," Harris agreed. "Something big, too, by the stink."

"Something big . . ." Audubon nodded, trying without much luck to control the electric jolt that coursed through him at those words. "Yes!"

Harris raised an eyebrow. "Yes, indeed. And so?"

"There aren't many big creatures in Atlantis," Audubon said. "It could be a dead man, though I hope not. It could be a dead deer or horse or cow, perhaps. Or it could be . . . Edward, it could be . . ."

"A dead honker?" Harris spoke the word when Audubon couldn't make himself bring it past the barrier of his teeth, past the barrier of his hopes, and out into the open air where it might wither and perish.

"Yes!" he said again, even more explosively than before.

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"Well, then, we'd better rein in, hadn't we, and see if we can find out?" Harris let out a creaky chuckle. "Never thought I'd turn bloodhound in my old age. Only goes to show you can't tell, doesn't it?"

He and Audubon tied their horses to a pine sapling by the side of the track. Audubon didn't worry about anyone coming along and stealing the animals; he just didn't want them wandering off. As far as he knew, he and his friend were the only people for miles around. This region was settled thinly, if at all. The two men plunged into the woods, both of them carrying shotguns.

A bloodhound would have run straight to the mass of corruption. Audubon and Harris had no such luck. Tracking by sight or by ear, Audubon would easily have been able to find his quarry. Trying to track by scent, he discovered at once that he was no bloodhound, and neither was Harris. They cast back and forth, trying to decide whether the stench was stronger here or there, in this direction or that: a slow, nasty, frustrating business.

And then, from the edge of a meadow, Harris called, "John! Come quick! I've found it!"

"*Mon Dieu!*" Audubon crashed toward him, his heart thumping and thudding in his chest. "Is it, Edward?" he asked. "Is it a—?"

"See for yourself." Harris pointed out to the curved lump of meat that lay in the middle of the grass and weeds.

"*Mon Dieu*," Audubon said again, softly this time, and crossed himself. "It is a dead honker. It *is*. And where there are dead ones, there must be live ones as well."

"Stands to reason," Harris said, "unless this one here is the very last of its kind."

"Bite your tongue, you horrible man. Fate wouldn't be so cruel to me." Audubon hoped—prayed—he was right. He walked out to the huge dead bird.

If any large scavengers had been at the corpse, Harris—or Audubon's noisy passage through the woods—had scared them off. Clouds of flies still buzzed above it, though, while ants and beetles took their share of the odorous bounty. Audubon stood upwind, which helped some, but only so much.

This wasn't one of the truly enormous honkers that had wandered the eastern plains before men found Atlantis. It was an upland species, and probably hadn't been as tall as Audubon or weighed much more than twice as much as he did. A great wound in the center of its back—now boiling with maggots—told how it died. That was surely a blow from a red-crested eagle: perhaps the one Audubon and Harris shot, perhaps another.

"Can you draw from this one?" Harris asked.

Regretfully, Audubon shook his head. "I fear not. It's too far gone." His sensitive stomach heaved. Even with the ground firm under his feet, the stench nauseated him.

"I was afraid you'd say that," Harris said. "Shall we take specimens—bones and feathers and such—so we have *something* to bring back in case we don't run into any live honkers?"

Messing about with the dead, reeking bird was the last thing Audubon wanted to do. "We *will* find live ones," he said. Harris didn't answer. He just stolidly stood there and let Audubon listen to himself and know he couldn't be certain he was right. The artist glared at him. "But I suppose we should preserve what specimens we can, in the interest of science."

Pulling feathers from the honker wasn't too bad. The black ones on its neck and the white patch under the chin testified to its affinity to Canada geese. The feathers on the body, though, were long and shaggy, more hairlike than similar to the plumage of birds gifted with flight.

Getting the meat from the bones and

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then cleaning them . . . Audubon's poor stomach couldn't stand the strain. He lost his breakfast on the green meadow grass and then dry-heaved helplessly for a while. A little rill ran through the meadow not far away. Perhaps the honker was going out to drink there when the eagle struck.

Audubon rinsed his mouth with cold, clear water from the rill . . . upstream from where Harris washed rotting flesh from the honker's right femur. The thighbone was larger and stouter than his own. Gathering himself, Audubon went back to the corpse to free the bird's pelvis. He brought it back to the rill to clean it. How long would his hands reek of decay? How long would his clothes? Would he ever be able to wear this outfit again? He doubted it. As he worked, he tried not to look at what he was doing.

His hands, then, told him of something odd: a hole in the bone on the left side of the pelvis that wasn't matched on the right. That did make him look. Sure enough, the hole was there, and a shallow groove leading to it. "See what I have here," he said to Harris.

His friend examined it, then asked, "What do you make of that?"

"Don't you think it comes from the claw of the red-crested eagle?" Audubon said. "You saw the talons on the bird. One could pierce the flesh above the bone, and then the bone itself. This is plainly a very recent wound: notice how rough the bone is all around the edge. It had no chance to heal."

After considering, Harris nodded. "I'd say you're right. I'd say you have to be right. You might almost have seen the eagle flying at the honker."

"I wish I would have!" Audubon held up the still-stinking pelvis. "I'll have to draw this. It holds too much information to be easily described in words."

"Let Mr. Owen look to his laurels, then," Harris said.

"I'll do the best I can, that's all," Audubon said. The detailed scientific illustration would have to be pen and ink, not charcoal or watercolor. It would also have to be unrelentingly precise. He couldn't pose the pelvis, except to show the perforation to best advantage, and he couldn't alter and adjust to make things more dramatic. His particular gift lay in portraying motion and emotion; he would have to eschew them both here. He clicked his tongue against the roof of his mouth. "An artist should be versatile, eh?"

"I know you can do it." Harris showed more confidence in him than he had in himself.

The smell of rotting honker came closer to spooking the horses than the eagle's blood had a couple of days before. The pack horse that carried Audubon's artistic supplies didn't want to let him anywhere near it. It didn't even want sugar from his stinking hand. He counted himself lucky to take what he needed without getting kicked.

He set the honker hipbone in the sun, then started sketching with a pencil. He tried and rubbed out, tried and rubbed out. Sweat ran down his face, though the day was fine and mild. This was ever so much harder—for him, anyway—than painting would have been. It seemed like forever before what he set down on paper bore any resemblance to the specimen that was its model.

When he was finally satisfied, he held up the sketch to show it to Harris, only to discover his friend had gone off somewhere and he'd never noticed. Painting took far less concentration. It left room for artistry. This . . . This was a craft, and one in which he knew himself to be imperfectly skilled.

He'd just inked his pen for the first time when Harris' shotgun boomed. Would that be supper or another specimen? *I'll find out*, Audubon thought, and set about turning his shades of gray into black and white. He had to turn the pelvis to compensate for the way shadows had shifted with the moving sun while he worked.

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Harris fired again. Audubon heard the blast, but didn't consciously register it. His hand never twitched. A fine line here, shading there to show a hollow, the exact look of the gouge the eagle's claw had dug before piercing the pelvis where the bone thinned . . .

"We've got supper," Harris said. Audubon nodded to show he heard. Harris went on, "And here's something for you to work on when you're done there."

That made Audubon look up. Along with a plump oil thrush, Harris carried a small, grayish, pale-bellied bird with a black cap. "An Atlantean tit!" Audubon said. The bird was closely allied to the tits of England and Europe and to Terranovan chickadees. Naturalists disagreed about which group held its nearest kin. At the moment, though, he was just glad he would be able to sketch and paint; to feel; to let imprecision be a virtue, not a sin. "Yes, that will be a change—and a relief."

"How's the drawing coming?" Harris asked. Audubon showed him. Harris looked from the paper to the pelvis and back again. After a moment, he silently lifted his broad-brimmed felt hat from his head, a salute Audubon cherished more than most wordier ones.

"Bones are all very well," the artist said, "but I want the chance to draw honkers from life!"

Audubon began to despair of getting what he wanted. He began to believe Harris' gibe was right, and he'd come along just in time to find the last honker in the world moldering in the meadow. Could fate be so cruel?

Whenever he started to fret, Harris would say, "Well, we've got something, anyway. We didn't know for sure we'd get anything at all when we set out." Every word of that was true, and it always made Audubon feel worse, not better.

He spent several days haunting the meadow where his friend found the dead honker, hoping it was part of a flock or a gaggle or whatever the English word for a group of honkers was. No others showed up, though. He found no fresh tracks in the mud by the rill. At last, sorrowfully, he decided the dead bird must have been alone.

"What if it *was* the last one?" he said. "To miss it by a few days . . . Why couldn't we have shot the eagle sooner? Then the honker would still be alive!"

He waited for Harris to be grateful again for what they had. But Harris surprised him, saying, "No use worrying about it. We don't *know* that eagle got that honker, anyhow."

"Well, no," Audubon admitted upon reflection. "Maybe it was some other villainous eagle instead." He got most affronted when Harris laughed at him.

Even though he was forced to admit to himself that honkers weren't going to visit the meadow, he was loath to leave it. He knew at least one live bird had frequented it up until mere days before. About what other spot in all Atlantis—in all the world—could he say the same?

He kept looking back over his shoulder long after he and Harris rode away. "Don't worry," said Harris, the optimist born. "Bound to be better land ahead."

"How do you know that?" Audubon demanded.

Harris surprised him by having an answer: "Because as best I can tell, nobody's ever come this way before. We're on a track now, not a road. I haven't seen any hoofprints besides the ones our horses are leaving for a couple of hours now."

Audubon blinked. He looked around—*really* looked around. "*Nom d'un nom!*" he murmured. "So it would seem." Pines and cycads and ginkgoes crowded close together on either side of the track. The air was fragrant with scents whose like he would find nowhere else. "This might almost be the antediluvian age, or another world altogether. What do you suppose made our trail?"

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"Anywhere else, I'd say deer. That may be so here, too, but I haven't seen any sign of them—no tracks, no droppings," Harris said. "Oil thrushes? Some of the other big flightless birds they have here? Maybe even honkers—who knows?"

That was enough to make Audubon dismount and minutely examine the surface of the trail in the hope of finding honker tracks. With their size and with the vestigial webbing between their toes, they were unmistakable. He found none. He did see oil-thrush footprints, as Harris had suggested: they reminded him of those of the European blackbird or Terranovan robin, except for being three or four times as large. And he saw a fox's pads, which stood out against the spiky background of bird tracks. Imported creatures penetrated even here, to the wild heart of Atlantis.

But of course, he thought. *Harris and I are here, aren't we? And we're no less fond of an oil-thrush supper than foxes are.*

A splash of vivid green on the side of a redwood sapling caught his eye as he rode past. At first, he thought it was some strange Atlantean fungus clinging to the trunk. Then, ever so slowly, it moved. "A cucumber slug!" Harris exclaimed.

The slug was almost the size of a cucumber, though Audubon would have fought shy of eating anything of that iridescent hue. Though it was neither bird nor viviparous quadruped, he stopped and sketched it. It was a curiosity, and one little known to naturalists—few of them penetrated to the cool, humid uplands where it lived. Eyestalks waving, it glided along the trunk, leaving behind a thumb-wide trail of slime.

"Maybe we'll come across some of those snails that are almost as big as your fist, too," Harris said.

"A shame to do it now, when we have no garlic butter." Audubon might draw the line at a cucumber slug, but he was fond of *escargots*. Harris, a Terranovan born and bred, made a horrible face. Audubon only laughed.

They rode on. The tracks they followed were never made by man. They twisted this way and that and doubled back on themselves again and again. Whenever Audubon came out into the open, he scanned the stretch of grass ahead with eager hope. How he longed to see honkers grazing there, or pulling leaves from tender young trees! How disappointed he was, again and again!

"Maybe that *was* the last honker in this part of Atlantis," he mourned as he and Harris made camp one night. "Maybe it was the last honker in all of Atlantis."

"Maybe it was," his friend replied. Audubon, toasting an oil-thrush drumstick over the flames, glared at him. The least Harris could do was sympathize. But then he continued, "We've come too far and we've done too much to give up so soon, haven't we?"

"Yes," Audubon said. "Oh, yes."

As the scents were different in this mostly pristine Atlantean wilderness, so too were the sounds. Enormous frogs boomed out their calls an octave lower than even Terranovan bullfrogs, let alone the smaller frogs of Europe. When Audubon remarked on them, Harris said, "I suppose you're sorry about the garlic butter there, too."

"Why, yes, now that you mention it," the painter said placidly. His friend screwed up his face again.

The big green katydids that might almost have been mice were noisier than rodents would have been, though some of their squeaks sounded eerily mouselike. But most of their chirps and trills showed them to be insects after all. Their calls made up the background noise, more notable when it suddenly ceased than when it went on.

Audubon heard birdsongs he'd never imagined. Surely some of those singers were as yet nondescript, new to science. If he could shoot one, sketch it

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and paint it, bring back a type specimen . . . He did shoot several warblers and finches, but all, so far as he knew, from species already recognized.

Then he heard the scream of a red-crested eagle somewhere far off to the north. He reined in and pointed in that direction. "We go there," he declared, in tones that brooked no argument.

Harris argued anyhow: "It's miles away, John. We can't hope to find just where it is, and by the time we get there it'll be somewhere else anyhow."

"We go north," Audubon said, as if his friend hadn't spoken. "The eagle may fly away, but if honkers are nearby they won't. They can't."

"If." Edward Harris packed a world of doubt into one small word.

"You said it yourself: we've come too far and done too much to give up hope." If that wasn't precisely what Harris had said, Audubon preferred not to be reminded of it. Harris had the sense to recognize as much.

Going north proved no easier than going in any other cardinal direction. Audubon swore in English, French, and occasionally Spanish when game tracks swerved and led him astray. The red-crested eagle had fallen silent after that one series of screeches, so it told him nothing about how much farther he needed to come. *Maybe it's killed again. Maybe it's feasting*, he thought. Even a freshly dead honker might do.

He and Harris came to a stream like a young river. Those Goliath frogs croaked from the rocks. "Can we ford it?" Audubon asked.

"We'd better look for a shallow stretch," the ever-sensible Harris said.

They found one half a mile to the west, and forded the stream without getting the horses' bellies wet. He unfolded a map of northern Atlantis. "Which stream do you suppose this is?" he said. "It should be big enough to show up here."

Harris put on reading glasses to peer at the map. "If it was ever surveyed at all," he said, and pointed. "It might be a tributary of the Spey. That's about where we are."

"I would have guessed it flows into the Liffey myself." Audubon pointed, too.

"Next one farther north? Well, maybe," Harris said. "The way we've been wandering lately, we could be damn near anywhere. Shall we go on?" Without waiting for an answer, he urged his horse forward. Audubon got his mount moving, too.

Not long after the murmur of the stream and the frogs' formidable calls—what Aristophanes would have done with them!—faded in the distance, Audubon heard what he first thought were geese flying by. He'd ridden out onto a grassy stretch a little while before. He looked north to see if he could spot the birds, but had no luck.

Harris was peering in the same direction, his face puzzled. "Geese—but not quite geese," he said. "Sounds like trumpet music played on a slide trombone."

"It does!" For a moment, Audubon simply smiled at the comparison. Then, sudden wild surmise in his eye, he stared at his friend. "Edward, you don't suppose—?"

"I don't know," Harris said, "but we'd better find out. If they aren't honkers, they could be nondescript geese, which wouldn't be bad, either. Audubon's geese, you could call them."

"I could," said Audubon, who'd never had less interest in discovering a new species. "I could, yes, but . . . I'm going to load my gun with buckshot." He started doing just that.

"Good plan." So did Harris.

Keep calling. Please keep calling, Audubon thought, again and again, as they rode through the forest toward the sound. The birds—whatever they were—did keep up the noise, now quietly, now rising to an angry peak as if a couple of males were quarreling over a female, as males were likely to do in spring.

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When Audubon thought they'd come close enough, he slid down off his horse, saying, "We'd best go forward on foot now." He carried not only his gun but also charcoal sticks and paper, in case. . . . Harris also dismounted. Audubon believed he would have brained him with the shotgun had he argued.

After perhaps ten minutes, Harris pointed ahead. "Look. We're coming to an open space." Audubon nodded, not trusting himself to speak. He too saw the bright sunshine that told of a break in the trees. The bird calls were very loud now, very near. "Would you call that honking?" Harris asked. Audubon only shrugged and slid forward.

He peered out from in back of a cycad at the meadow beyond . . . at the meadow, and at the honkers grazing on it. Then they blurred: tears of joy ran down his face.

"Blessed art Thou, O Lord, Who hast preserved me alive to see such things," he whispered, staring and staring.

Harris stood behind a small spruce a few feet away. "Isn't that something. Isn't that *something*?" he said, his words more prosaic than his friend's, but his tone hardly less reverent.

Eight honkers grazed there, pulling up grass with their bills: two males, Audubon judged, and half a dozen smaller females. The birds had a more forward-leaning posture than did the mounted skeletons in the Hanover museum. That meant they weren't so tall. The males probably could stretch their heads up higher than a man, but it wouldn't be easy or comfortable for them.

And then they both moved toward the same female, and did stretch their necks up and up and up, and honked as loudly as ever they could, and flapped their tiny, useless wings to make themselves seem big and fierce. And, while they squabbled, the female walked away.

Audubon started sketching. He didn't know how many of the sketches he would work up into paintings and how many would become woodcuts or lithographs. He didn't care, either. He was sketching honkers from life, and if that wasn't heaven it was the next best thing.

"Which species are they, do you suppose?" Harris asked.

Once, at least a dozen varieties of honker had roamed Atlantis' plains and uplands. The largest couple of species, the so-called great honkers, birds of the easily accessible eastern lowlands, went extinct first. Audubon had studied the remains in Hanover and elsewhere to be ready for this day. Now it was here, and he still found himself unsure. "I . . . believe they're what's called the agile honker," he said slowly. "Those are the specimens they most resemble."

"If you say they're agile honkers, why then, they are," Harris said. "Anyone who thinks otherwise will have to change his mind, because you've got the creatures."

"I want to be right." But Audubon couldn't deny his friend had a point. "A shame to have to take a specimen, but . . ."

"It'll feed us for a while, too." The prospect didn't bother Harris. "They *are* supposed to be good eating."

"True enough." When Audubon had all the sketches he wanted of grazing honkers and of bad-tempered males displaying, he stepped out from behind the cycad. The birds stared at him in mild surprise. Then they walked away. He was something strange, but they didn't think he was particularly dangerous. Atlantean creatures had no innate fear of man. The lack cost them dearly.

He walked after them, and they withdrew again. Harris came out, too, which likely didn't help. Audubon held up a hand. "Stay there, Edward. I'll lure them back."

Setting down his shotgun, he lay on his back in the sweet-smelling grass,

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raised his hips, and pumped his legs in the air, first one, then the other, again and again, faster and faster. He'd made pronghorn antelope on the Terranovan prairie curious enough to approach with that trick. What worked with the wary antelope should work for agile honkers as well. "Are they coming?" he asked.

"They sure are." Harris chuckled. "You look like a damn fool—you know that?"

"So what?" Audubon went on pumping. Yes, he could hear the honkers drawing near, hear their calls and then hear their big, four-toed feet tramping through the grass.

When he stood up again, he found the bigger male only a few feet away. The honker squalled at him; it didn't care for anything on two legs that was taller than it. "Going to shoot that one?" Harris asked.

"Yes. Be ready if my charge doesn't bring it down," Audubon said. Point-blank buckshot should do the job. Sometimes, though, wild creatures were amazingly tenacious of life.

Audubon raised the shotgun. No, the agile honker had no idea what it was. This hardly seemed sporting, but his art and science both required it. He pulled the trigger. The gun kicked against his shoulder. The male let out a last surprised honk and toppled. The rest of the birds ran off—faster than a man, probably as fast as a horse, gabbling as they went.

Harris came up beside Audubon. "He's down. He won't get up again, either."

"No." Audubon wasn't proud of what he'd done. "And the other male can have all the females now."

"He ought to thank you, eh?" Harris leered and poked Audubon in the ribs.

"He'd best enjoy them while he can." Audubon stayed somber. "Sooner or later—probably sooner—someone else will come along and shoot him, too, and his lady friends with him."

By then, the rest of the honkers had gone perhaps a hundred yards. When no more unexpected thunder boomed, they settled down and started grazing again. A few minutes later, a hawk soared by overhead—not a red-crested eagle, but an ordinary hawk far too small to harm them. Still, its shadow panicked them more thoroughly than the shotgun blast had. They sprinted for the cover of the trees, honking louder than they did when Audubon fired.

"Would you please bring my wires, Edward?" the artist asked. "No posing board with a bird this size, but I can truss him up into lifelike postures."

"I'll be back directly," Harris said. He took longer than he promised, but only because instead of carrying things himself he led up the pack horses. That gave Audubon not only the wires but also his watercolors and the strong spirits for preserving bits of the agile honker. If he and Harris did what he'd told the customs man they wouldn't do and drank some of the spirits instead of using them all as preservatives . . . Well, how else could they celebrate?

Audubon soon got to work. "This may be the last painting I ever do," he said. "If it is, I want to give my best."

"Don't be foolish. You're good for another twenty years, easy," Harris said.

"I hope you're right." Audubon left it there. No matter what he hoped, he didn't believe it, however much he wished he did. He went on, "And this may be the last view of these honkers science ever gets. I owe it to them to give my best, too."

He wired the dead male's neck and wings into the pose it took when challenging its rival. He had the sketches he'd made from life to help him do that. His heart pounded as he and Harris manhandled the honker. Ten years earlier, or even five, it wouldn't have seemed so hard. No, he didn't think he had twenty more left, or anything close to that.

Live for the moment, then, he told himself. *It's all there is.* His eye still saw;

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his hand still obeyed. If the rest of him was wearing out like a steamboat that had gone up and down the Big Muddy too many times . . . then it was. When people remembered him, it would be for what his eye saw and his hand did. The rest? The rest mattered only to him.

And when people remembered agile honkers from now on, that too would be for what *his* eye saw and what *his* hand did. Even more than he had with the red-crested eagle, he felt responsibility's weight heavy on his shoulders.

The other honkers came out from the trees and began grazing again. Some of them drew close to where he worked. Their calls when they saw him by the male's body seemed to his ear curious and plaintive. They knew their fellow was dead, but they couldn't understand why Audubon stood near the corpse. Unlike a hawk's shadow, he was no danger they recognized.

The Sun was setting when he looked up from his work. "I think it may do," he said. "The background will wait for later."

Harris examined the honker on the paper, the honker vibrant with the life Audubon had stolen from its model. He set a hand on the painter's shoulder. "Congratulations. This one will last forever."

"Which is more than I will. Which is more than the birds will." Audubon looked down at the dead honker, agile no more. "Now for the anatomical specimens, and now for the dark meat. Poor thing, it will be all flyblown by this time tomorrow."

"But your painting will keep it alive," Harris said.

"My painting will keep its memory alive. It's not the same." Audubon thought again about how his heart had beat too hard, beat too fast. It was quieter now, but another twenty years? Not likely. "No, it's not the same." He sighed. "But it's all we have. A great pity, but it is." He drew his skinning knife. "And now for the rest of the job . . ." ■

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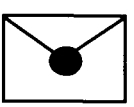

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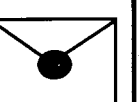

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Testosterone Replacement: Beyond Viagra to Successful Aging

Fran Van Cleave

The world's best-known hormone needs a good press agent. Blamed for every malady from war to prostate cancer to prematurely dead athletes, testosterone is the Prometheus of the endocrine glands, carrying the fire of life to both men and women. Necessary not just for potency and sexual desire (though that is certainly reason enough to replace it), this unjustly vilified hormone now appears to be vitally important for the heart, the brain, and indeed one's very sense of self. In an aging population awash in estrogen and synthetic anti-androgens, and afflicted by one expensive Band-Aid cure after another, testosterone is finally being recognized as of far greater importance than "natural Viagra."

Viagra, by the way, does *zero* for the libido. It is a vasodilator approved for erectile dysfunction, or ED as the TV commercials so blithely call it.

History

Humans have sought a cure for the maladies of aging since Adam found his first gray hair, and most cures have focused on the "essence of maleness." Two thousand years ago, a Roman physician, Aretaeus of Cappadocia, wrote an essay on the vitality of man residing in the testes. The Greek physician Galen believed that life was a function of heat

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derived from sperm at conception, and that aging occurred when that heat begins to dissipate. A thousand years later, the Chinese attempted to extract this male essence from the urine of young men, using it to treat infertility, impotence, and enlarged prostates. In the nineteenth century, French physiologist and former Harvard professor Charles-Edouard Brown-Séquard took this a step further by "drinking an extract of crushed dog testicles" with which he claimed to have "recovered the strength and vigor of a young man." After his article about this appeared in *The Lancet*, doctors emptied their prescription pads writing for his new potion. Unfortunately for Brown-Séquard, it didn't actually work, and he became the butt of many jokes. Just after World War I, France was again swept by anti-aging fever in the person of Russian émigré Dr. Serge Veronoff, who transplanted ape testicles into aging Parisians. Not to be outdone in the realm of quackery, an American doctor named John Romulus Brinkley offered the same procedure to his patients, but with goat testicles—presumably these were easier to obtain—and became so wealthy from the practice, he bought a radio station and ran for governor of Kansas.

This sort of thing tended to scare away scientists who valued their reputations, but in spite of that, solid work was done. In the 1920s, Fred Koch, an organic chemist who lived close to the Chicago stockyards, was able to extract a substance from bull testicles which, when injected into capons, turned them into roosters. Other scientists isolated and crystallized the testosterone molecule. In the 1930s, a Yugoslav scientist named Leopold Ruzicka discovered that testosterone enters the blood rapidly after the Leydig cells of the testes produce it, which explained why Brown-Séquard and the Parisian doctors had had such limited success with animal glands. After Ruzicka found that testosterone could be synthesized from cholesterol, he was awarded the Nobel Prize.

Testosterone's Activity In the Body

"Hormone" comes from the Greek word for *impulse*, and according to *Dorland's Illustrated Medical Dictionary*, refers to a chemical substance, which has a specific regulatory effect on the activity of a certain organ. An androgen, or masculinizing hormone, testosterone is a structural steroid—a *very* loose term for fat-like substances whose progenitor is cholesterol—affecting every cell in the body. The normal range for an adult male is wide: from 350 to 1000 nanograms per deciliter of blood.

Most of that, however, is inactive. When the hypothalamus signals a need for testosterone, production proceeds apace in the Leydig cells and to a lesser extent, in the adrenal glands (in women, the ovaries and the adrenals make testosterone). About 97% of circulating testosterone is bound to proteins, either a blood protein called albumin, or another known as SHBG, sex hormone binding globulin. Under some circumstances, the 20 to 40% bound to albumin may be useful physiologically, but the only portion you can truly count on to be active is the unbound "free" testosterone, which constitutes only 1 to 3% of the total. Not much, is it? With age, total testosterone shows little or no decrease, but the percentage of free testosterone declines—in some cases drastically.

The hormonal system is complicated, but its regulation through a negative feedback loop can be simplified thusly: testosterone forms three important byproducts 1) androstenedione (a weak androgen), 2) dihydrotestosterone (DHT, the strong testosterone, implicated in baldness), and 3) estradiol (the most potent human estrogen). The hypothalamic signaling process for testosterone production is inhibited by estradiol, and to a lesser extent by DHT.

Between production and destruction, testosterone does many other things be-

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sides masculinize the body and lead the unsuspecting mind into a politically incorrect fantasy life. It promotes growth of bone and muscle; improves oxygen uptake in tissues, helps control blood sugar[1]; maintains the immune system; improves mental concentration and mood; regulates cholesterol; and increases production of nitric oxide, which dilates blood vessels and can be thought of as an endogenous nitroglycerin tablet.[2]

Lest you think this last activity occurs in only one part of the body, let me add that there are more receptors for testosterone in the heart than in any other tissue. Not that strange when you think about it, since testosterone is a powerful muscle-building hormone, and the heart is the hardest-working muscle in the human body.

Does this mean that a *lack* of testosterone might be bad for the heart? Might this lack actually be a causative factor in cardiovascular disease? How could that be, when for so many years, conventional wisdom has held that the *presence* of testosterone is a major factor in heart disease, and quite possibly the primary reason men die at a younger average age than women?

Fascinatingly, many studies have found a correlation between low levels of testosterone and heart disease. The well-known Caerphilly Heart Disease Study, conducted in Wales on 2,512 men, found heart disease, higher insulin levels, and lower levels of HDL (the heart-protective "good cholesterol") all associated with significantly low levels of testosterone.[3]

It's possible that low testosterone could be a result of heart disease instead of the cause. In China, doctors intrigued by these studies decided to treat heart disease with testosterone. In the Wu study[4], 60 of the 62 elderly male volunteers had had a heart attack within the five years prior to the study, and all had documented angina. Half of the participants were given testosterone, the other half placebo. Of those receiving testosterone, 77% experienced relief from anginal pain, while 6% of the placebo group reported this improvement. This self-reporting was verified by echocardiography, which showed an improvement in coronary blood flow in 69% of the testosterone group versus 8% on placebo. These results were provocative, though clearly rigorous proof demanded larger and more detailed studies.

In 1994, the American M.D. Gerald Phillips at Columbia University College of Physicians and Surgeons decided to do a cross-sectional study of 55 men (mean age 61) who had abnormal stress tests, some of whom also had chest pain.[5] Blood samples taken from these men showed a stark inverse relationship between levels of testosterone and severity of cardiovascular disease. Levels of free testosterone showed an even more profound contrast. Low levels correlated with important risk factors for heart attack, e.g. greater tendency for the blood to clot, higher levels of insulin and insulin resistance, and lower levels of HDL. In prior studies with men who had not had heart attacks, Phillips documented low testosterone levels correlating with central obesity ("spare tire syndrome"), high blood pressure, and increased levels of cholesterol, triglycerides, glucose, and clotting factors.

Interestingly, blood clots are also associated with *high* doses of anabolic steroids.

Anabolic steroid drugs are *not* the same as testosterone, but resemble the molecule in some ways. As Figure 1 shows, so does the powerful estrogen known as estradiol, which illustrates the dangers of making too much of a mere resemblance! We've all heard news stories of athletes misusing anabolic steroids and paying the physical price with liver damage, clots, and strokes. Those stories are accurate. At low doses, anabolic steroids tend to exert a favorable effect on clot-busting fibrinogen,

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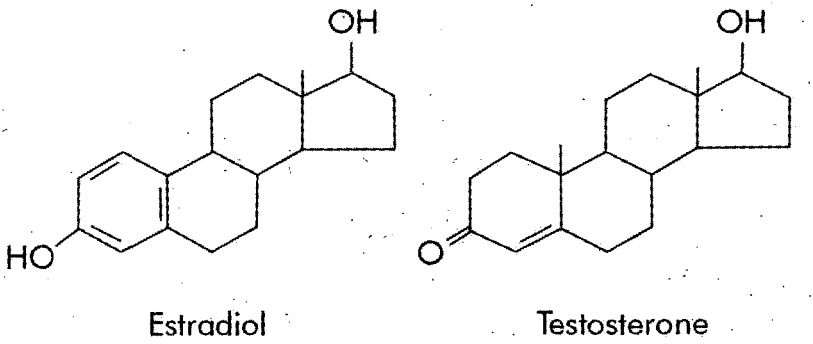

Figure 1. Structures of Estradiol and Testosterone. (Adapted from Gennaro, A. et al., *Remington's Pharmaceutical Sciences*, 17th Ed. 985-1000. Easton, PA: Mack Publishing 1985.

but at high doses, they clearly increase the tendency of red blood cells to stick together, which means blood clots. Anyone desperate enough to use these black market testosterone impersonators will probably not use them in low doses, and in any case, other problems with these molecules make them unsafe in any quantity.

Normal testosterone levels, on the other hand, hinder blood clots by reducing the amount of a powerful clotting factor called plasminogen activator inhibitor, also known as PAI-1. This substance inhibits the release of one of the blood's chief clot-busting enzymes, tissue-type plasminogen activator or tPA, which helps dissolve the protein known as fibrin, the core of the clot. Testosterone's control of PAI-1 allows tPA to be released from the endothelial cells on the inside of arteries into the bloodstream, where it can vanquish the offending clot before it does any harm.[6]

This may sound confusing, but what it all boils down to is this: the symptoms Phillips documented are no longer seen as independent risk factors for heart disease, but are now being tied together as Syndrome X or Metabolic Syndrome. Which suggests that what we think of as different diseases—obesity, clotting problems, Type II diabetes, cardiovascular disease—*are all manifestations of the same disease.*

Sounds a lot like aging, doesn't it?

According to a report in the Proceedings of the National Academy of Sciences, testosterone appears to aid in both the prevention and treatment of Alzheimer's disease (women with the disease outnumber men by a factor of almost 2:1, though this may be due in part to the larger number of elderly women). Researchers at the University of Texas-Houston found that testosterone prevented hyperphosphorylation of a brain protein called tau, and this in turn prevents the formation of snarls of filaments in the brain known as neurofibrillary tangles, a hallmark of the disease.[7]

Does testosterone do anything to alleviate America's other expensive and debilitating disease of aging, osteoporosis? Indeed, it does. Testosterone grows and strengthens bone as well as muscle, and studies have confirmed that serum testosterone levels are powerful predictors of bone mineral density and total body bone mineral content in independent-living elderly men.[8] You still have to exercise and take calcium with Vitamin D, but testosterone will get you a *lot* more mileage from these activities.

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Today, one third of those with fragile-bone fractures are men, and as men live longer, that percentage is bound to increase. The 25 million osteoporosis patients in the U.S. and their yearly accumulation of 1.5 million fractures cost over $10 billion a year to treat, and by 2050, the world's total number of hip fractures (which frequently result in death from secondary pneumonia) is predicted to reach 6.26 million.[9]

So why didn't modern medicine understand the benefits of testosterone a long time ago, and use it to combat these problems? Several reasons. First, it is almost impossible to do a double-blind study and *keep* it blinded about who is getting the real testosterone. Second, the therapeutic picture was confused by the body's rapid conversion of testosterone to estrogen, creating *tremendous* dispute over which hormone does what. The third reason has to do with testosterone being a "natural" substance—i.e., it cannot be patented.

The first problem is self-evident, but what's the story on the second one? Most people know that men and women have both "male" and "female" hormones, but why and how does the body change a *masculine* hormone into a *feminine* one?

The Battle of the Hormones

As the molecular structures in Figure 1 show, testosterone and estradiol are not nearly so different as one would suppose from their activity in the human body. In males, an enzyme called aromatase converts testosterone to estrogen, and it is a simple process. (Perhaps we should stop calling these molecules "male" and "female." Men genetically deficient in aromatase show no functional abnormalities save a general lack of sexual desire.) A large testosterone/estrogen ratio, generally ranging between 20 and 40 to 1, is ideal for health and function in men, but increasing age and obesity drop the ratio by increasing levels of aromatase and estradiol production. Estradiol can unlock or displace testosterone at its receptor sites, preventing free testosterone from doing its job. While it's good to be able to switch off the libido occasionally, it's not good to have it stuck in the off position, which too much estradiol does. That's one of the reasons why women on hormone-replacement therapy also need testosterone.

Fatty tissue in both men and women produces estrogen, so for women, being overweight can be thought of as something of a mixed blessing, since this estrogen delays the onset of menopause. This hormone is important in the brains of both sexes for thinking and memory, but its excess brings a surfeit of problems, most strikingly in men: narrowing of coronary arteries and increased risk of heart attack, blood clots, diminished energy, and a faltering sex life. Not too surprisingly, a UCLA study in 1988 found significant correlation between high levels of estrogen in men and impotence, and estrogen's deleterious effect on weight-loss programs adds insult to injury. A man can't even eat a steak without ingesting a little estrogen from the high-potency additives in cattle feed (these were banned in Europe in 1991). Considering the enormous increase in obesity in the United States in the last few decades, it appears that American testosterone is drowning in an ocean of estrogen.

Like so many things in life, hormones are about balance.

Which brings us to problem three, the lack of patentability of testosterone. Balance became increasingly problematic with the use of synthetic hormones favored by drug companies.

The Pharmaceutical Model: How Problem-Solving Leads to Problems

Over the years, drug companies have come to rely on a business model that goes something like this: identify a disease, syndrome, or symptom; ferret out its biochemical mechanisms; then devel-

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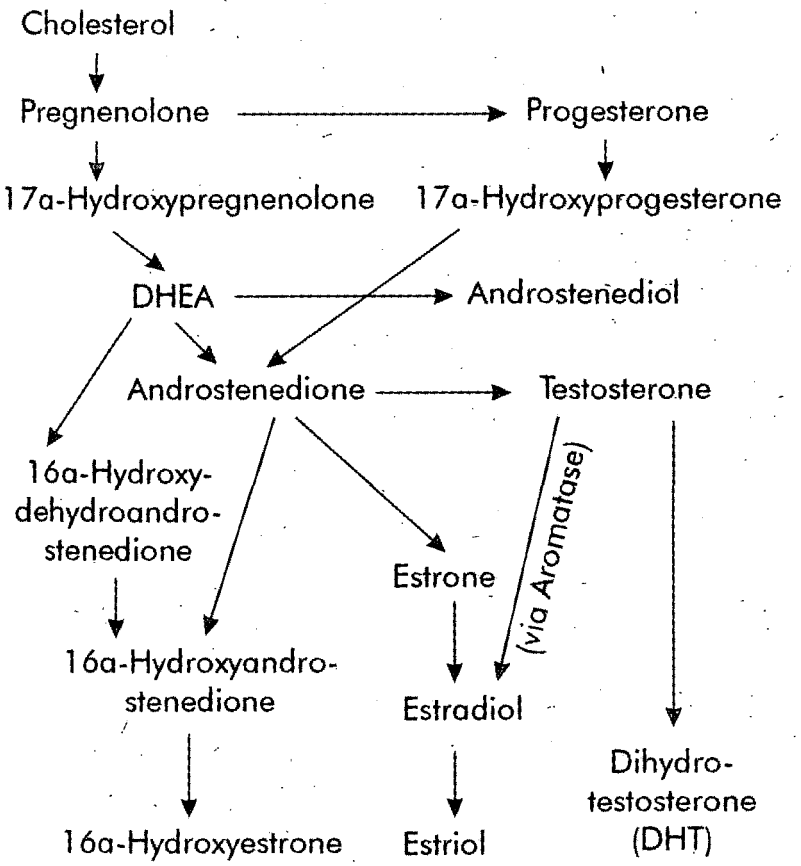

Figure 2. Simplified "Family Tree" for Testosterone

op a chemical that targets those mechanisms, usually through blockage or inhibition. This seems like a logical approach, and it often is, but alien molecules don't process well in human hormonal systems. That's one reason why DES, the artificial estrogen diethylstilbesterol, was such a disaster.

Because testosterone cannot be swallowed without causing liver toxicity as well as a host of other problems (all pain, no gain), most of the early synthetic versions were injectable anabolic steroids. At first it seemed like a good idea to improve on nature by making stronger and longer-lasting chemical hormones.

But as Figure 2 shows, the endocrine system is nothing if not dynamic. While many men experienced improvement of symptoms, particularly at first, this was quickly followed by a severe downturn. Not only did their bodies convert a large portion of these super-potent male hormones to estrogen, they also produced more sex hormone binding globulin, so the poor fellows ended up with a worse testosterone/estrogen ratio and an even

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smaller percentage of free testosterone than they started with!

Unfortunately, a number of researchers did not measure estrogen levels, and also made no distinction among testosterone esters, anabolic steroids, and bio-identical human testosterone. (Rather than employ the fuzzy, exhausted adjective "natural" to describe the testosterone molecule found in humans, I will use "bio-identical" for clarity.) The wild mood swings of the test subjects were blamed on testosterone. And why not? Everyone knows male hormones are what make people fly into rages and become violent.

Well, if we accept that supposition, it's difficult to understand how any women, save genetic abnormalities, ever become angry or violent, given the small average quantity of testosterone in women compared to men. Nevertheless, it happens, and more frequently than many people would care to admit. The argument is often made that prenatal exposure to hormones is more critical to personality than one's own postnatal levels, and that is probably true, but there is no good scientific evidence to show that in primates, higher levels of testosterone cause higher levels of violence. The "'roid rage" displayed by athletes injecting large quantities of black market anabolic steroids is often seen in those with high estradiol levels, as evidenced by the athlete's shrunken testes and fatty tissue deposition in the breasts. It seems probable that an unsuitable *combination* of hormones makes it harder to think, thus making violence more likely.

In any case, researchers eventually realized that rebound estradiol was ruining all their gains. There had to be a better way to supplement testosterone. A few researchers went back to bio-identical testosterone and figured out methods to deliver it slowly, without the sharp peaks in blood level caused by injections. This was more complicated than making a "tiny time pill," since nothing could change the dangers of popping bio-identical testosterone like a vitamin tablet, but it turned out to be a much more successful approach. Not only did the test subjects show greatly improved testosterone/estrogen ratios with few side effects, the delivery systems (skin patches, sublingual tablets, gels, and pellets) could be patented!

While a delivery system is nowhere near as profitable as an original drug, in the case of testosterone, the safety profile made it the only choice.

The Andropause

Estimates have it that 20% of men above 60 years of age are deficient in testosterone. Since this is embarrassing to admit to, and hormonal screenings are not widely done, it is likely that the problem is under-reported. This low-testosterone state is referred to by many names: andropause, hypogonadism, "the gray years," and "male menopause." The latter term makes about as much sense as "jumbo shrimp," but most people use it in preference to the more logical andropause. (The existence of this syndrome is still disputed by those who believe it isn't real if it isn't as sudden and dramatic as the female version.)

Andropause is characterized by fatigue, low or zero libido, weight gain, osteoporosis, insomnia, cognitive impairment, and depression. Often these men don't care that they're not interested in sex anymore—that's another symptom—but they're miserable at not being able to recognize themselves in the sharp-voiced, grumpy, forgetful person they've become. A number of medications—Prednisone, Tagamet, Prozac, Aldactone, Dilantin—can cause this syndrome at a relatively young age, but no matter when andropause occurs, the sufferer shouldn't resign himself to enduring this ghostlike existence. *And he no longer has to.*

The goal is, as anthropologist Ashley Montague said, to "die young, as late as possible." And what could be better

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than to live a happier, healthier life that costs less than an unhealthy and unhappy one?

Testosterone Replacement

According to the October 2004 issue of *Pharmacy Times*, between 1998 and 2003, sales of testosterone products increased from $18 million to $400 million. Business is definitely booming.

Because of the abuse of anabolic steroids, testosterone is now classified as a controlled substance. You can't buy it without a prescription. Also, since a normal hormone level for one man may be quite abnormal for another, you can't just walk into a doctor's office and walk out with a box of testosterone patches. Taking blood levels provides only a partial answer, because most men don't have their own youthful blood levels to compare them to. Supplementing to a level right for any individual can be tricky, and side effects can occur, ranging from a possible decrease in HDL, the good cholesterol, to an increase in PSA, an important early warning sign of abnormal prostate growth.

It's unclear, however, whether testosterone and other androgens cause prostate growth or inhibit it. There's evidence on both sides. Generally, American physicians tend to regard testosterone as dangerous to the prostate, while their European counterparts incline to the opposing view. It's also unclear whether testosterone will exacerbate existing cancer, but most doctors would consider that a serious contraindication.

Finally, there are some men for whom testosterone replacement does not work, probably because hypertensive and/or oxidative damage to small blood vessels has gone on past the point of no return. For those in whom it can work, the question of which *form* of testosterone replacement to use is critical to success or failure.

There are six principle methods: lozenges, patches, gels and creams, pellets, injections, and dietary.

Lozenges absorbed through the gums are an easy and reliable way of increasing testosterone. About 9% of patients experience gum irritation initially, but at least some of that goes away, and the lozenge is not affected by eating, tooth brushing, or drinking alcohol. It should be taken two or three times a day, as levels begin to fall five or six hours after the lozenge is gone. This may be irksome to remember, but that mimics testosterone's normal diurnal rise and fall in young men, which is all to the good. Since testosterone lozenges are not yet mass-marketed, they are made by a compounding pharmacy according to a doctor's specifications.

Patches do not need to be made by a compounding pharmacy; you can buy them anywhere that sells prescriptions. The cash price is about $200 a month, and the chief side effect is a red circle on the skin from the patch adhesive, which sometimes turns into a rash. Providing a slow, steady release of testosterone, patches work well for men who need a medium-sized boost in hormonal levels, up into the 500 ng/dl range. Those with higher levels in youth may still not feel normal in this range, and would probably do better with lozenges or pellets.

Gels and creams are convenient and easy to use, *provided you accurately measure your daily amount*. They're used once or twice a day, and women find this delivery method particularly useful for their own supplementation needs. Gels and creams cause less skin irritation than patches—creams are the best of the three—but there is a possibility some could rub off on your partner. Gels are available in regular pharmacies; creams must be mixed in compounding pharmacies. Cost is about $200 per month.

Pellets are surgically implanted in the buttocks every four to six months. This is a minor procedure done with a painkiller, and delivers a slow, steady infusion in the 600 to 900 ng/dl range.

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The main side effect is extrusion of the pellets, which occurs in about 8% of patients. When calculated by the year, the cost is slightly less than for patches or lozenges. The FDA approves only one manufacturer in the U.S., Bartor Pharmacal in Rye, New York.

Injections are the cheapest way to go and cause the most unwanted side effects, including the worst rebound in estradiol. Most of the studies showing negative effects from testosterone used injections. Not recommended.

Fortunately, in a large proportion of men with declining levels of free testosterone and increasing levels of estradiol, hormone ratios can be dramatically improved by simple, inexpensive lifestyle and dietary changes. Simple changes are sometimes the most difficult to stick with, but in this case, they're certainly worth the effort.

If you're overweight, lose weight. Please, not an extremely low-fat diet—that lowers testosterone, too. A sensible balanced diet combined with a minimum of two hours of exercise a week, aiming to cut 500 calories a day, will lose about a pound a week, 20 pounds in four months. Curbing alcohol consumption is another biggie. Even a few drinks inhibit the liver's ability to excrete estradiol, so you wind up with more estrogen circulating in your body—for women, the increase is a dramatic threefold after just one drink. (This doesn't mean eliminate alcohol, just cut back.) Taking 50mg of zinc twice a day does the opposite, *decreasing* estrogen by decreasing the aromatase conversion enzyme. Zinc also helps the testosterone system function better. It is quite common for people eating the standard American diet to be deficient in zinc.

Eating more cruciferous vegetables, such as broccoli and cauliflower, will also help excrete estrogen. Vitamin C, one to three grams a day, and niacin are also good in this regard, but please *don't* take high doses of niacin (more than 250mg) if you're also taking a statin drug to lower cholesterol. Though some doctors do this deliberately, the combination increases your chance of developing rhabdomyolysis, a severe destruction of muscle tissue that can be fatal.

My last suggestion is the supplement DHEA—the hormone dehydroepiandrosterone, made by the adrenal glands. Middle-aged men and women generally feel better when they take it. However, it can be converted to many other hormones besides testosterone, including estrogen. Women who take doses in excess of 50mg a day may produce too much testosterone, which can manifest as acne, facial hair, and deepening of the voice.

What About Prostate Cancer?

While some doctors believe that high testosterone levels cause prostate malignancy, there's little evidence for that, and much to contradict it.

Two European doctors, British Dr. Malcolm Carruthers and French urologist Georges Debled, have treated thousands of men with testosterone over the last thirty years, and have not seen any increases in their patient population of either prostate cancer or benign prostatic hypertrophy.[10] This of course is not the same as doing a long-term longitudinal study, and until one is done, the sensible thing is to have a PSA test before supplementing with testosterone.

The worst culprit appears to be the Western diet. In Okinawa and Hong Kong, yearly deaths from prostate cancer amount to four per 100,000—but after residents of these parts of the globe move to the U.S., their death rates rocket up to the same 28 per 100,000 as U.S. citizens who have lived here all their lives.[11] The primary protector in their diets appears to be tofu, which contains flavonoids. These compounds behave much like selective estrogen receptor modulators, the drugs used to prevent and treat breast cancer. Flavonoids are also found in flax, beans, tea, onions,

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and apples, but given the high levels in tofu, it might be a good idea to swap some of that estrogen-laden beef for an occasional tofu burger.

Pollution and Falling Sperm Counts

As if changing your relationship with meat and vegetables weren't enough to deal with, we may also have serious problems with plastic wrap and pesticides.

In 1992, a group of Copenhagen scientists correlated the results of 61 surveys of sperm count from around the world taken from 1940 to the 1990s, and published the results in the British Medical Journal. In the early surveys, 50% of the subjects had sperm concentrations of over 100 million per milliliter, but by the 1990s, that proportion had dropped to only 16%. The percentage of men with 20 million sperm per milliliter—now considered "low normal" in fertility clinics, though it was once three times that—climbed from 6% in the 1940s to 18% in the 1990s. Most of the surveys were done in the U.S. or western Europe, but low sperm counts were also found in India, Nigeria, and Peru.[12]

Given the enormous variability among men—or even one man from one day to the next—it's difficult to pin down the cause. However, since testosterone exerts such a powerful effect on the quantity of human sperm, it's worth looking to see if there is anything in the environment hostile to testosterone that didn't exist in the 1940s.

And there is. Phthalates, which have shown powerful anti-androgen effects in animal experiments, are everywhere in plastics, and prone to leach out during microwave cooking. The common exposures are below the levels that caused pathology in the animal experiments, but no one has done a study on phthalates and human sperm counts, so we don't know what the level of harm might be. Another problem chemical is dibromochloropropane, DBCP, which in small amounts proved extremely toxic to sperm in men exposed to it. Though banned, DBCP has shown a distressing tendency to hang on in the fat deposits of humans and animals. There are many other pesticides with estrogen-like effects, but again, we don't know the level of harm they may impose on testosterone or sperm. I'm not advocating the precautionary principle ("ban everything we imagine *could* be harmful"), nor claiming that any of this constitutes ironclad proof; I'm simply observing that there's something here that clearly merits scientific study.

Coins In the Fountain of Youth

Americans are rightfully concerned about Medicare's $100-billion cost balloon over last year's estimates, and if the past is any guide, that cost gap will explode again in 2011 when the Boomers start retiring. But suppose our pharmaceutical approach changes?

What if, instead of treating each of the symptoms of andropause with its own drug, we treated them all with a single hormone? Or even more radically, what if a few of the drug companies did a big clinical trial comparing the standard treatments of Syndrome X with testosterone treatment? (It won't be easy, what with the difficulty of keeping testosterone trials blinded, but someone should be up to the challenge.)

Add 'em up. Viagra 100mg, $10 a tablet. Lipitor 20mg for cholesterol, $96 for 30 days. Fosamax 70mg for osteoporosis, $75 a month. Ambien 10mg for insomnia, $84 a month. I won't go into the drugs for Alzheimer's, which are *really* expensive. Suffice it to say that next to all this, $200 a month is a bargain, and the price will likely drop when increased demand increases competition and decreases manufacturing costs.

Done correctly, male hormone replacement may not only reignite those smoldering home fires, it could save your brain, your heart, your bones, and quite possibly add years to your life. Not to mention Medicare's.

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We'll see what happens between now and 2011.

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Fran Van Cleave is a pharmacist who writes freedom-oriented science fiction. She lives in Indiana with her philosopher husband.

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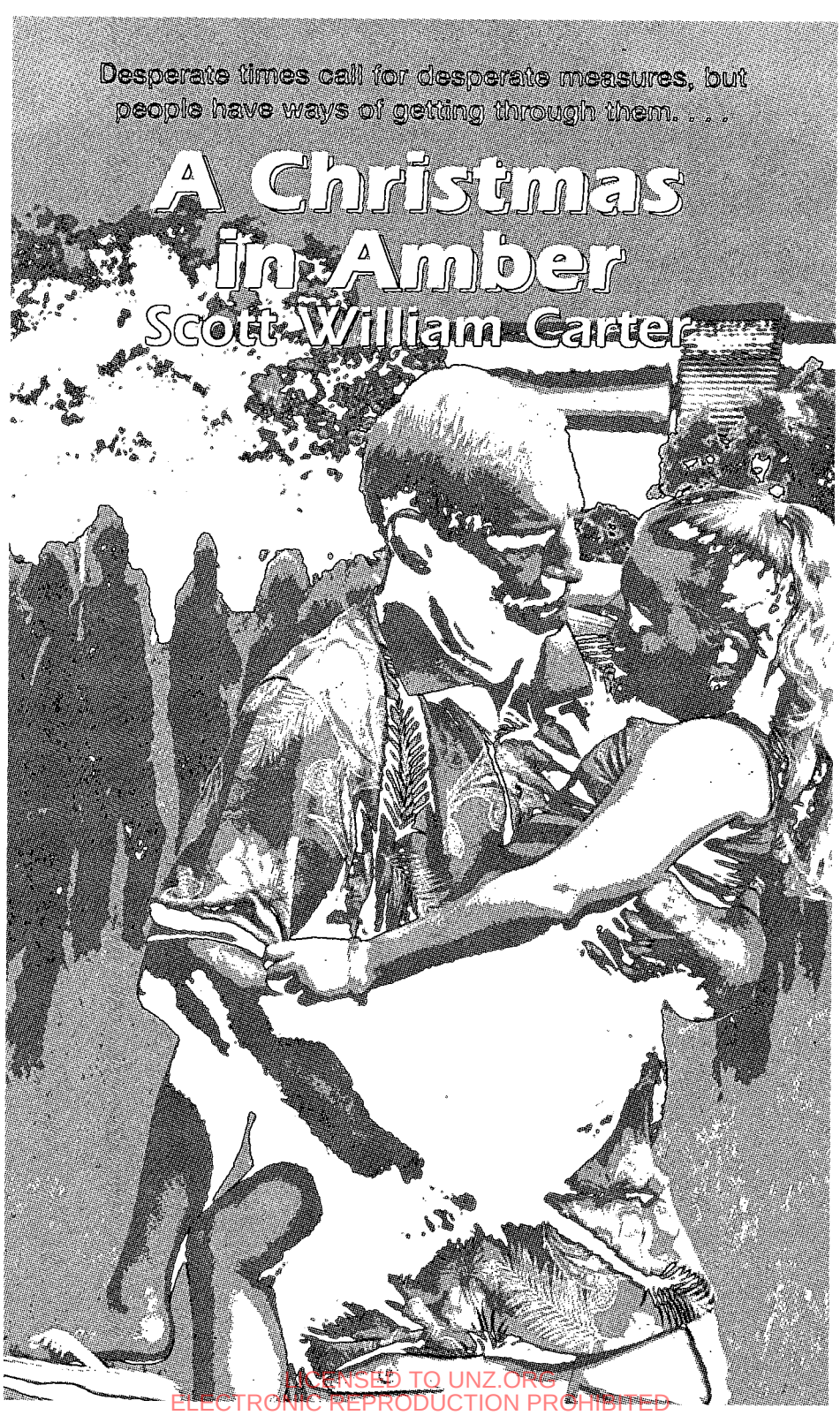
Desperate times call for desperate measures, but people have ways of getting through them. . . .

A Christmas in Amber

Scott William Carter



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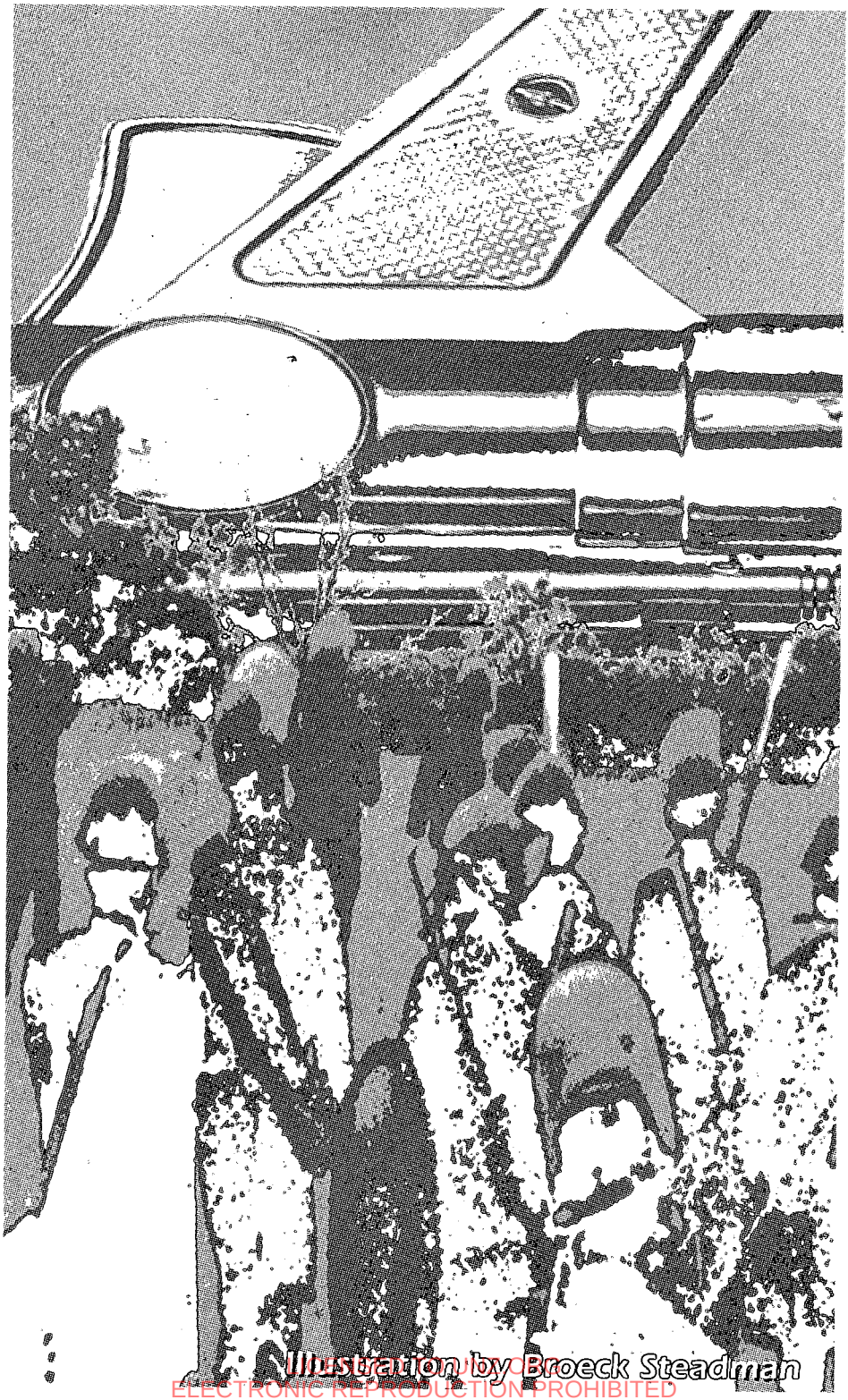

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The snowflakes barely touched the glass before they melted, the moisture swept aside by his humming windshield wipers, but Alan was still mesmerized. Not a word had been said about snow on any of the Evacuation Updates. Rain had been the forecast. Lots and lots of rain. It had been many years since he had seen real snow—twenty or thirty at least, back when Janis was still alive. And that had been at a ski resort, not Los Angeles. The last time he could remember it snowing in Los Angeles was when he was still in his twenties, some fifty years back, and he could *never* remember it snowing on Christmas Day.

The snowflakes wafted through the golden halos surrounding the streetlights before they vanished on the glistening pavement. He was amazed at how deserted the streets were. *That* never would have happened if not for the evacuation. There'd be gobs of kids outside trying to make snowballs. Every house in the subdivision looked the same, with gabled windows and brick facades, posh and expensive in every respect, so identical Alan was surprised when the autopilot turned the van into a driveway. He had been to the house lots of times, but still he couldn't tell it apart from the others. Only when he saw Michelle's face pressed against the bay window, hands cupped on either side, did he know he was in the right place.

She wore the purple A's baseball cap he had bought her when they attended the game the previous year. The blinking holiday lights around the window made her face green one moment, red the next. When she saw him, she waved excitedly and disappeared through the part in the curtains. So they hadn't told her. If they had told her, he doubted she would be smiling.

A sharp sadness stabbed at his heart. For a moment, he wondered if this was a good idea.

"Open all doors," he said.

The van's computer beeped in acknowledgement. The two front doors, the sliding side door, and the back doors all popped open. In his haste to get to his son's house on time, he had forgotten his jacket, and the chill wind sliced right through his thin cotton sweater. If Janis were still alive, he knew what she would say. Stepping out onto the pavement, he could hear her voice.

You trying to get pneumonia, Alan? Is that what you want?

"It's not like it matters now, dear," he said, catching himself when he realized he was speaking out loud. He had been hearing her a lot lately, and he had been trying hard not to answer. If the kids heard him, they'd worry.

The driveway was lit by two lamps, one on either side of the garage. The air smelled like the old pines that lined the street. The front door to the house slid open and Rick emerged, bulging brown leather suitcases under each arm. His hands were covered with thick mittens. He was dressed in the type of heavy blue parka somebody on an expedition up Mount Everest might wear, as well as bright red ski pants, a brown wool cap with earflaps, and yellow rain boots, all of which looked brand new. Under all that garb his face was tanned a deep bronze, which Alan knew was a requirement of the part Rick had been playing—a professional surfer on that soap opera. This amused Alan to no end; as far as he knew, Rick had never been surfing. He hated both swimming and the ocean.

An image of Rick surfing in his current outfit flashed through Alan's mind, and he chuckled.

"What's so funny?" Rick asked, breath fogging. His curly black hair ruffled in the breeze. Janis had always called him muffin head because of his dome-like hair.

"Nothing," Alan said.

"It's cold."

"Yes, it is."

He made a motion to take the bags, but Rick shook his head and walked

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past. Katherine came out next, also dressed in a heavy coat and pants, also carrying bulging suitcases. The difference was that her clothes matched: they were solid white, hugging her model-thin body, and stylishly designed. Her blond hair was pulled back into a braided ponytail, sticking out the side of her Russian-style fur hat. Michelle came out right behind her, dressed in the same coat as her mother, but otherwise in rumpled jeans faded in the knees, dirty tennis shoes, and of course, the baseball cap. He knew her hair was as blond as her mother's, but it was cut so short you couldn't see it underneath the hat. A black backpack was slung over her shoulders, and he saw the eyepiece of her microscope jutting out the top.

How her parents had ever ended up with a child so dissimilar to them Alan couldn't say, but he was glad for it. She was more like him than his son had ever been. She was even saying she wanted to grow up to be a paleontologist. The thought of that made his chest tighten, and he forced it away.

"I'll help you," he said to Katherine, taking one of her bags.

"Oh, thank you," Katherine said, breathing a sigh. Up close, he saw that she was perspiring, her cheeks pink. Alan wondered if she had lifted anything that heavy in years. It must have been hard being without servants, he thought sarcastically, and then felt guilty for thinking it. He and Katherine had never gotten along great—hell, he and Rick had never gotten along great—but he needed to be positive now.

"*Dear*," Rick said from behind the van, "think of his back."

"I'm fine," Alan said, but he did feel a twinge. Damn thing had been bothering him for years.

Rick made a noise that sounded like *hummmph*. It was a sound Janis used to make, a sort of disgusted resignation. Janis had been in the business, too, a television director. They had always been close, Janis and Rick. They had a bond that Alan could never understand.

Kind of like him and Michelle.

"Hey, sport," he said to her.

She beamed up at him, smiling with sealed lips. He knew she was embarrassed about the gap in her teeth. She had lost them a few months earlier, a couple of days shy of her sixth birthday. He also remembered that her parents, obsessed with the preparations they needed to make after they received winning lottery numbers, had forgotten to put money under her pillow. Grandpa had given her a ten, telling her the tooth fairy had come to his house by mistake. She was a smart kid, too smart to believe this, but she had nodded just the same.

The snowflakes dotted the brim of her cap before turning into dark watermarks.

"You all packed, huh?" he said.

"Yeah," she said. "Hey, Grandpa, guess what? We get to go on a spaceship!"

"I know," Alan said.

As if Alan might drop the bag at any moment, Rick quickly snatched the bag from him, scooting it into the van. Then he helped Katherine with her other bag. Alan helped his granddaughter take off her backpack, all while she chatted nonstop.

"Mommy says only a few people get to take a ride on the spaceship and we're lucky," she said. "She says we're going to be gone a while so I better take all the stuff I want to play with, so I made sure to bring my microscope."

"I see that," Alan said. "You bring any of your fossils?"

"No," she answered glumly. "Mommy says they're too heavy."

"Well, she's probably right."

"But I do have this!"

She reached into her pocket and pulled out an object that fit into the palm of her hand. When the lamps shone on the yellowish plastic, he knew what it was. He had bought it for her when they visited the California Academy of Sciences in June. The plastic

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looked more yellow than honey-colored; it was meant to look like amber, a facsimile of a new species of termite that had been found in Colombia, encased in amber, perfectly preserved after sixty million years. He had offered to buy her a t-shirt, but she had insisted on the little keepsake.

"Ah," he said, and for a moment he couldn't speak.

With the luggage secured, they boarded the van, everyone absorbed in grim silence. Except for Michelle. She talked about how she had never been in a spaceship and how it would be so much fun to tell everyone at school about it—when she started going to school again, whenever that was. Alan punched in the coordinates of the airport, and Rick, in the passenger seat, struggled to leaf through their evacuation paperwork with his mittens. As they pulled away from the house, Alan tried to think of something to say, something to lighten the mood.

"What's wrong, Mommy?" Michelle asked.

"Hmm?" Katherine said softly. "Oh, nothing."

"But you're crying. Did you hurt your hand on the seat belt?"

"Yes, dear. That's it."

"Okay. I'm sorry. I hurt my finger once on one of Grandpa's seat belts, too. It hurts."

"I've got an idea," Alan said. "Why don't we sing some Christmas carols? I think that would be a lot of fun." He tried to sound jovial, but he knew his voice wasn't ringing true. "'Jingle Bells,' anyone?"

"Maybe we should focus on watching the road," Rick said. "There might be some crazies out there, and the autopilot doesn't always know what to do."

"I'd like to sing," Michelle protested.

Katherine sniffled. "Yes, let's."

"All right, fine," Rick said. "Just don't let the van drive too fast, okay? We have plenty of time. We don't need to hurry. Hurrying we'll just get us in an accident."

Alan felt his irritation rise, then let it go. He was amazed he could feel irritated even today of all days. He cleared his throat and began to sing with his scratchy voice, and Katherine and Michelle quickly joined him. Rick focused his attention on his papers for a few blocks, as if there was something there that he could have possibly missed, but soon even he was singing. And that's how they passed the time as they made their way along the slick roads, the vents blasting warm air, the tires sloshing through water, soon out onto the ghostly highway, hardly a car on it. So many people already gone, and those that weren't had headed somewhere in the middle of the country, though he knew it could hardly help them. The asteroid coming their way was bigger than the United States.

When they finished that song, they launched immediately into "Frosty the Snowman," then "Silent Night," then "Rudolph the Red-Nosed Reindeer." He couldn't remember them singing like this *ever*, and here they were singing fools. When they were nearly to LAX, he wondered if they should be talking more seriously, but he didn't know what the point of it all would be. What needed to be said had been said well enough in the previous months. Now there was only the parting.

The only person he *hadn't* talked to about what was happening was Michelle, and he wasn't sure he could bring himself to do that.

It wasn't long before they had reached the airport, navigated through three different checkpoints manned by soldiers, past tanks and jeeps with guns trained on them, down a special road to a gated area full of hundreds of cars parked in neat rows separated by red cones. Papers were checked, retinas scanned. At the last gate, they had to get out, and their car was thoroughly searched, their bags run through an X-ray machine before being tagged and

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dropped into the back of a pickup truck. In the gated area bright fluorescent lights mounted high in the air gave the place the feel of a sporting event. Hundreds of people were making their way slowly to the far end, where out in the middle of the tarmac sat the white transport plane, it, too, surrounded by enough artillery and soldiers to subdue a small country. The transport ships, fat, white, and ungainly in appearance, had been nicknamed "spaceducks." Now, surrounded by all that army green, it seemed all the more like a duck—a duck sitting on a grassy bank.

For the past two months, all over the world, the spaceducks had been ferrying the lucky few up to *Little Earth*. And *that* ship, as big as a hundred football fields, with a self-contained ecosystem that could theoretically (but only theoretically) maintain itself indefinitely, would carry a little over ten thousand passengers and crew to RNL-875—a planet around a star much like the Sun, some 157 light years away. The best scientists in the world had determined that planet, out of the hundred or so identified, to have the best chance of having an environment hospitable to humans.

Alan knew that scientists had pegged the actual odds at something like one in ten thousand, and that was mostly guesswork and wishful thinking, but nobody talked about that much. In any case, it would be hundreds of generations before the ship arrived.

They parked the van and fell in line with the others, heading toward the last X-ray and retina arch before the tarmac; a dozen yards beyond that were the stairs up to the ship. The snowflakes were gone now, the air thick with a wet mist that clung to his skin. Michelle took his hand. Her fingers were small but warm within his own.

"Why is everybody crying?" she asked.

Rick and Katherine trailed behind, and he heard Katherine start crying again, Rick shushing her. All around them, much the same thing was happening. The line was moving quickly. They would be to the final gate in no time, Alan knew. He just had to keep moving. One foot in front of the other.

Alan swallowed. "It's hard saying goodbye."

"But they seem so sad," Michelle said.

"Yes."

"Are they sad because they don't get to go on the spaceship?"

He didn't answer. They were only ten or eleven people from the front, and a woman near the gate suddenly threw herself against the fence and was shouting someone's name, soldiers quickly pulling her back. Was it Frank? Or Hank? Watching this, Alan knew he could no longer lie to Michelle. The truth may have brought out some ugly things in people, but at least it was truth. When she was older, he knew she would mostly likely look back on this day with sadness, but he didn't want her to look back feeling betrayed.

"No," he said, looking down at her, attempting a smile. "They're sad because . . . because they're leaving. Leaving and not coming back."

He saw the skin underneath her eyes quiver. "What?"

"I'm sorry, honey. We didn't tell you until now because we didn't want you to be upset."

"But why?"

"Well, there's this asteroid that's heading toward Earth—"

"Jimmy across the street told me about that," she said quickly. "Daddy said they shot it down with a laser. They said it won't hurt anyone." Her grip on his hand tightened.

Alan nodded. "Your daddy told you that because he didn't want you to worry about me. You see, dear, I'm not going with you."

Michelle stopped, looking at him with an expression of shock and hurt he wished immediately he had never seen. There was only one group ahead of them, a family of five, and the arch

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beeped as each child passed underneath.

"I'm sorry," he said. "You see, only a few people can go on the ship that's going to take you to a new home. Old people like me don't get to go, but you and your parents are lucky ones."

He was waiting for her to cry, but the tears didn't come. Instead she looked furious, releasing his hand and clenching her fists.

"But I don't want to go without you!"

"I'm sorry, dear."

"They can't make me."

Katherine touched her daughter's shoulder. "Honey," she began, but Michelle pulled away.

"No! I'm staying if Grandpa stays!" She grabbed Alan's hands and looked up at him with a pleading expression. "Please don't make me go, Grandpa! Please, I want to stay with you."

They were to the last arch; the plastic was bright yellow, like a children's playground toy. The soldiers waited silently, but he could see the impatience in their eyes. He wondered why any of them were even bothering to do this, then he knew that they must have also been lucky ones. They just had one last job to do before they got to board a transport ship of their own.

He bent down in front of Michelle and took her gently by the shoulders. "You know I love you," he said.

She swallowed. The tears still hadn't come, but he knew they weren't far away now. "I love you too, Grandpa."

"But you've got to go with your mommy and daddy. They need you very, very much. And I want you to grow up and be happy, and you can't be happy here with me."

"Yes, I can—"

He put a finger on her lips, quieting her. "Please, don't argue. Just go."

She nodded, though she now looked dazed. He kissed her forehead, looking away so he wouldn't see her crying. If he saw her crying, he knew his strength would desert him. He'd end up just like that woman throwing herself against the fence. He hugged Katherine, then Rick, said a few words of goodbye that had already been said, and then the three of them were ushered through the archway. Alan got to watch them for only a moment before a soldier escorted him out of the line and to a roped-off area where dozens of people stood along the fence. There were no lights in this area, and their faces were shadowy and dark. Alan wondered if that was deliberate. He didn't want to see these people's faces.

He took his place alongside them, and by then Rick, Katherine, and Michelle were entering the ship. He saw Michelle looking around frantically. He waved, but she didn't see him.

"Michelle!" he shouted.

She turned, perhaps not seeing exactly where he was, but definitely looking in his direction. Then she was in the ship. He knew he shouldn't have done it, but he wasn't the only one. Lots of people shouted. He heard a sound, a heavy thumping, and for a moment he thought it might be the asteroid crashing through the atmosphere, since he had no idea what that would sound like, and then he realized it was the pounding of his own heart. A few minutes later the rest of the passengers were in the ship. A woman in an orange jumpsuit was at the hatch, closing it. This is it, Alan thought. They're really leaving.

And then, before the hatch was closed, he saw the woman in orange stumble to the side. A figure emerged, short, dressed in a white jacket, running down the steps. When he recognized Michelle, he cried out, reaching as if he could grab her, his hand finding only the cold and damp metal fence. All around him others were crying out as well. It was as if she had fallen into an ocean full of sharks and they all stood helplessly on the boat.

The two soldiers at the bottom, who had turned aside, now turned back, but Michelle was already at the bottom. She ran for Alan. "Grandpa! Grandpa!" she

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cried.

She was surprisingly fast for such a little girl, so fast she may have surprised the soldiers, because she was halfway to Alan before they broke into a run. They gained on her quickly, but she was nearly to Alan already, slowing when she got close to the fence.

"Grandpa?" she said.

He hesitated for a second, but then his resolve broke. "Here," he said. "Here, Michelle, here!"

She dashed to the fence with the soldiers, two thin men with assault weapons slung over their shoulders, close behind. Other soldiers were also approaching. Alan bent down to meet her, reaching to embrace her, forgetting that there was a fence in the way. His fingers closed around the gaps, and then her smaller fingers were over his own.

"Grandpa!"

The light was bad, but he saw the grim horror on her face, the desperation. All of these soldiers here to prevent the unexpected, he thought, and all it took was a six-year-old girl to disrupt them. The first two soldiers grabbed her and began to pull, but she released Alan's fingers and grabbed onto the fence, screaming. Try as they might, they couldn't pull her away. They had her whole body in the air and still they couldn't pry her off the fence.

"Damn kid," one of them muttered.

"Don't hurt her!" Alan said.

"Grandpa! Grandpa!" Michelle cried.

The other soldiers had reached them now, a half dozen of them all looking the same in the dark. A tall, bald man with a silver mustache stepped between the two who were holding Michelle. "Put her down," he said.

The two obeyed, putting Michelle back on her feet. Her white-fingered grip on the fence didn't slack, and she pressed up against the metal.

"I won't go!" she said.

"Please, Michelle," Alan said.

"No!"

"If you don't go," the man with the silver mustache said, "you'll be left behind."

"I want to stay with Grandpa!"

"Don't you want to be with your parents?"

"I want to stay with Grandpa!"

"Oh, for heaven's sake," the man with the silver mustache said. "We don't have time—"

"Wait," Alan said. "Let me come over there. I'll walk her up."

The man with the silver mustache looked at him skeptically. All those guns, Alan thought.

"Please," he begged.

The man with the silver mustache looked at him a moment more, then nodded back toward the gate. As Alan ran, some of the soldiers on the other side jogged along side him. There was a moment of fuss at the arch, a few words spoken on radios, and then he was ushered through the beeping mechanism, the soldiers on the other side guiding him back to Michelle. He was still a few steps away from her when she turned and threw herself into his arms.

"I don't want to go!"

He stroked her hair, feeling the warmth of her face through his damp sweater. He knew there was nothing now he could say to comfort her. The truth was what it was. With his own private army accompanying him, he turned and headed for the plane. Two people in orange jumpsuits, a man and a woman, watched him from the top of the steps. Michelle's body shook with each breath. The yelling and shouting from the spectators had stopped; he knew they were all watching. When he started up the stairs, feet clanging on the metal, the soldiers stopped and gathered at the bottom.

With each step, his legs seemed heavier. He wasn't sure he was going to make it, but then there he was, at the top, placing Michelle on her feet between the two people in orange.

"There now," he said, his throat constricting.

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She looked up at him with wet eyes, cheeks glistening. He steadied her with a hand on her shoulder.

"Grandpa," she said.

"It's for the best, honey. Please do it for me."

"But—"

"I know."

"I want—"

"Yes, but you still have to go."

Her chin dropped, and she looked down for a moment before turning toward the ship. Then she turned back suddenly, her hand reaching into her jacket pocket and emerging with the amber-like keepsake. She thrust it at him.

"I want you to have this," she said.

"But it's yours."

"But I want *you* to have it."

He nodded and took it from her, kissing the back of her hand when he did so. She turned, not a trace of emotion on her face, and the two people in orange closed in behind her. He placed the keepsake in his pocket, then without waiting, turned and started back down the steps. He had to go quickly. He would not even wait for the ship to take off. He had to get out of there.

When the hatch clanged shut, he jumped. The soldiers watched him as if he was the walking dead, and he knew that to them perhaps he was. When he reached the bottom, a few patted him on the shoulder. The man with the silver mustache personally saw him back to the viewing area, shaking his hand and saying something inaudible before turning and leaving. Some people in the crowd asked him questions, but he didn't listen. He moved close to the fence, pressing his face up against the cool metal, and watched the plane.

The regular engines started turning, rumbling; the plane lurched forward. Even where he stood, he felt the frigid air pushing against him. He knew when it was up higher, the rocket engines would take over for the last leg of the journey. Science, his old friend, would see his family into space.

"Some Christmas," he heard Janis say behind him.

The plane taxied along the runway, gathering speed. As he watched the ungainly white bird sail up into the darkness, he thought about Christmases past and Christmases future. He thought about a huge hunk of rock hurtling toward the Earth. He thought about little girls with microscopes and insects encased in amber. He thought about the meaning of the word hope.

"The best ever," he said. ■

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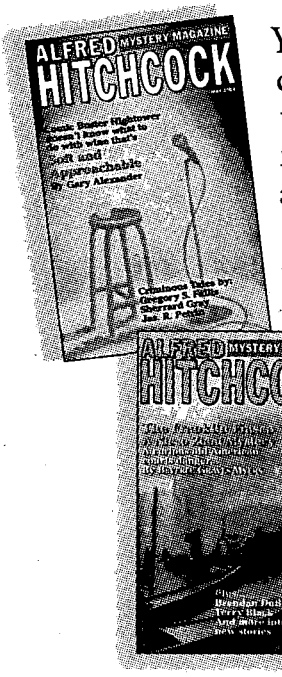

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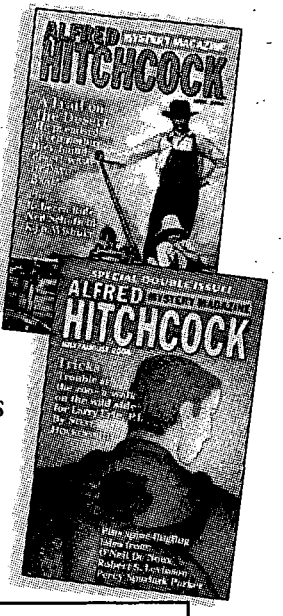

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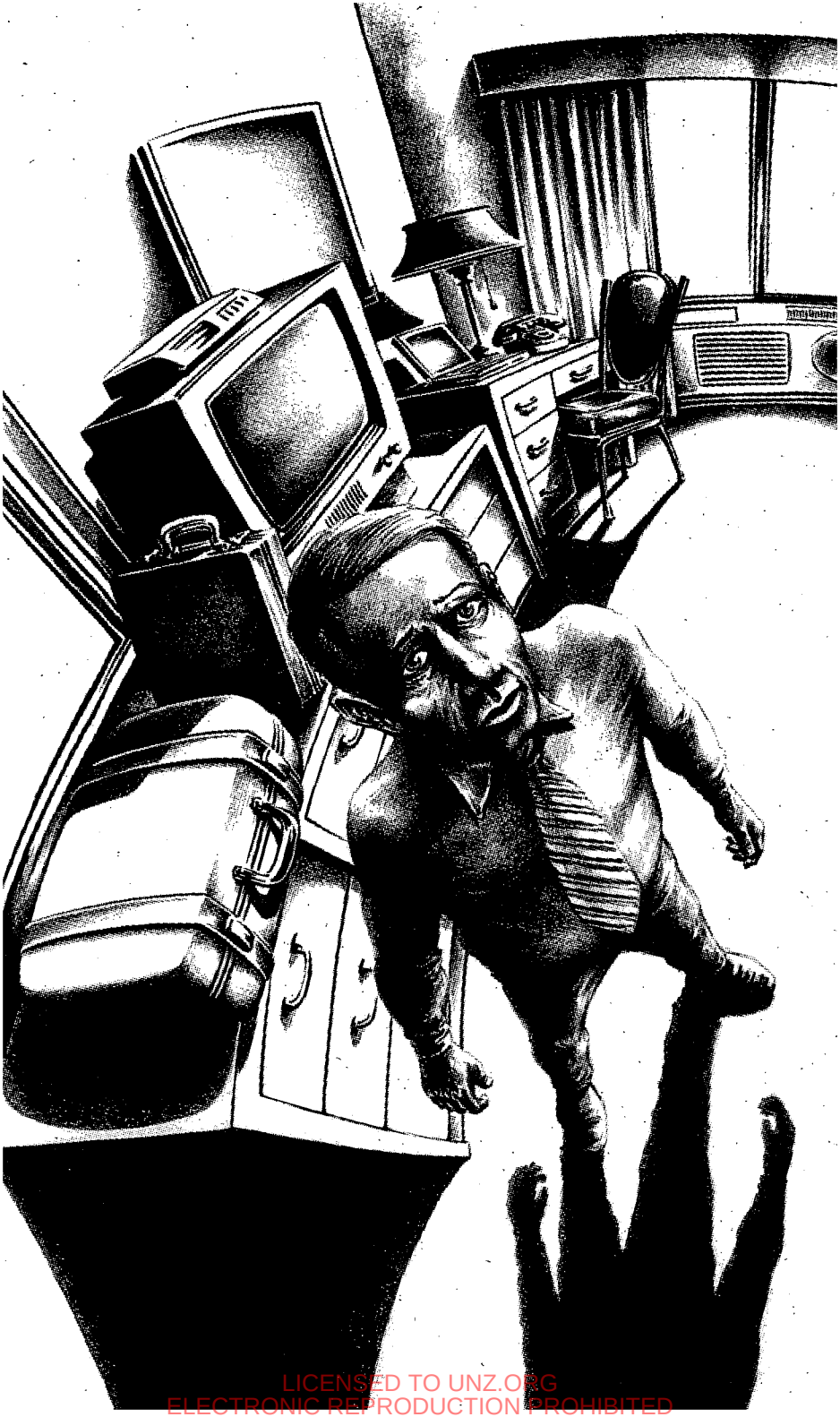

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The petard you're hoist by may be your own. . . .

HOTEL SECURITY

Carl Frederick

Illustration by Vincent DiFate

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"Mag card or retinal scan?" said the hotel night clerk. "Or both if you want to give a key to a visitor."

Roger Royce glanced at the scanner and forced a smile. "Scanner," he said. "Left eye."

"Oh," said the clerk, a look of surprise on his face. "You've done this before." He pushed a button and the scanner swiveled out to the front of the reservations desk. "Almost everyone chooses the card." As Roger leaned in, his left eye over the metal guide, the clerk added, "People seem almost afraid of this thing."

"I have reservations about this," said Roger, "but scanners are the way of the future." His smile edged toward a scowl. Although he much preferred the mag card, he was duty-bound to choose the scanner. After all, it was probably because of him that the hotel even *had* a scanner.

A flash came from the lens and Roger then bent to pick up his overnight bag and laptop.

"Excuse me, sir," said the clerk. "But I need to see a photo ID, please."

Roger put down his baggage and took out his wallet. His hand hesitated over his driver's license before withdrawing instead, a phony ID. Performing a spur of the moment test, Roger handed the "Eastern Lycanthropic" identification card to the clerk.

The clerk glanced at it and passed it back. "Thank you, Dr. Royce. Your room number is 2217. Shall I write it down?"

"No, thank you." Roger picked up his bags.

"Enjoy your stay at the Neotel Riverside," said the clerk. "Have a good night."

Roger bit his lip for a moment before saying, "Thank you" and then heading toward the elevator. He'd considered apprising the clerk of the lapse of security, but decided there was no need to make an issue of it and embarrass the man. Roger smiled, thinking that the encounter would make a good opening anecdote for his speech in the morning.

As he walked, Roger noticed the announcement monitor showing the next day's events. He grimaced as he read the first entry.

National Hotel Security Conference
9:00 AM Galaxy Room
Breakfast Keynote Speech
Dr. Roger Royce—Chief Scientist,
Hotel Security International
"Hotels—The First Line of
Defense against Terrorists"

Waiting at the elevators, he took a long glance around the lobby. This was the first time he'd stayed at a Neotel. But except for the retinal scanner, there didn't seem to be anything particularly "neo" about it. At least nothing that could be seen. He did know that it had the very latest security system. He had designed some of it.

The elevator came, rose, and deposited him on the twenty-second floor. Only then did he note that he'd forgotten his room number. It would be embarrassing to return to the reservation desk, so he spent the next couple of minutes eyeing each of the doors until a retinal lock displayed green. With a sigh of relief, he felt the door handle engage. A light came on as Roger walked into his hotel room.

"Welcome to your room," came a cheerful voice from a dressing table. "I am your information butler." Roger, smiling, shook his head and set his bags on the desk. "Just pick up the phone and push the 'Information Butler' button—and I'll be there to assist you."

The wall color changed and, after a few seconds, changed again. Then the walls ran through a rainbow of colors.

Roger watched, speechless. He'd known these technologies existed, but had never stayed at a hotel employing them.

"Neotel provides user-configurable accommodations," said the voice. The

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room reverted to its original beige hue. "You can use the touch panel by the window to change the wall colors, or simply ask me to change them for you."

The picture on the wall then exhibited the same instability—changing from a landscape to a tiger to the Mona Lisa, then finally to a view of the White House. "You can use the panel under the picture, or just ask me. I can even help you upload images from your laptop or from many brands of cell phones."

Music began to play, but Roger couldn't tell where the sound came from.

"And music, of course," said the information butler. The 1812 Overture gave way to Pachelbel's Canon and then to silence. "And for a small fee, you can even specify a scent. Maybe fresh-cut grass, or salt water over craggy rocks. Just pick up the phone and push 'Information Butler.'" After a pause of about a second, the voice from the dressing table said, "There are no better accommodations to be had than at a Neotel. We are the best!"

"Oh, vanity!" said Roger, lightly. "I'm accustomed to more modest accommodations."

Roger smiled. The place did have its geeky pleasures. In the morning, he intended to try some of the "user-configurable" toys. But now, he was too tired. He stripped down and headed for the bathroom. *If the toilet talks to me, I'll probably lose it.*

A few minutes later, ready for bed, he pulled back the covers and flopped down prone on the sheets. The sheets weren't hotel-room cold; the bed was obviously pre-warmed. Roger tap-switched off the light and gave a sigh of relaxation.

"Hi there," came a voice from deep within the bed.

Roger rolled over sharply and sat upright. "What?"

"I am your model SSC-IB2 Intelligent Bed from Sleepsmarts Corporation."

"You're kidding," said Roger.

"No, not at all," said the bed. "Is the mattress to your liking? I can make it harder or softer."

"Good grief," said Roger, "This is real AI with voice recognition."

"Indeed, I am." The bed's voice was mellow and soothing. "Is the mattress to your desired firmness?"

"I'd like it a little firmer," said Roger, less interested in his mattress than in testing the limits of the bed's language processing.

"Be so good as to lie down," said the bed. "That makes for a more accurate adjustment."

"How do you know I'm not lying down?"

"There are pressure sensors throughout the mattress. It is an active mattress, accommodating to your movements during the night."

"Fine, then." Roger stretched out with his nose on the pillow. "Make it firmer," he said, wondering if the bed could understand him in spite of his voice being muffled by the pillow.

"Just say stop," said the bed, "when it is optimally comfortable."

"Oh, stop," said Roger after a few moments. "This is perfect."

"Glad to be of service."

Roger pulled the covers over him. "Good night, bed."

"Good night."

A few moments later, Roger rolled over onto his side and reached for the phone. "Rats!" he said. "I always forget to ask for a wakeup call."

"I can do that," said the bed. "What time do you wish to be awakened?"

"What? Oh. Six o'clock, please."

"Wakeup call at six, sharp," said the bed. "Good night."

"Good night," said Roger, "and thanks." He shook his head against the pillow. *What am I doing? Being polite to a simple AI—well, maybe not exactly simple.*

Roger spent a fitful few hours. Not even the comfort of the SSC-IB2 Intelli-

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gent Bed could make sleep less elusive than it had been of late.

He rolled over and glanced at the clock radio. "Oh, no," he said. "Only two in the morning."

"What's wrong, sir?" said the bed.

Forgetting where he was for an instant, Roger started. "What?"

"Do you need medical assistance? I heard you groaning in your sleep."

Memory having returned, Roger relaxed. "No. No, I'm fine." Then he sat up. "You said 'sir.' How did you know I was male?"

"From profiling. Your weight is 182 pounds and I estimate your height at five feet, ten inches. And during the course of your motions during sleep, the mattress sensors detected determining features of your anatomy. By the way, your Body Mass Index is 26.1."

"Oh, gosh." Roger plopped down on the sheets. "It's the stress. I'm putting on weight." He bit his lower lip. *I'm doing it again; I'm explaining myself to a talking bed.*

"There's a good health club at this hotel." The bed's voice sounded eager. "You could work off those pounds. The club is free during your stay. And the yearly membership fee for non-guests is quite reasonable—or so I've been instructed to say."

"No. I'm just not sleeping well."

"I am very sad to hear that," said the bed.

Roger smiled. "Sad? How can an AI be sad?"

"My sleeper-satisfaction algorithm indicates that I am failing in my purpose."

"And what exactly is that purpose?"

"My purpose"—the bed spoke as if intoning a mantra—"is to assure you of a good night's sleep."

"Then your sadness is justified." Roger rolled face down and buried his face in the pillow. "I don't suppose," he said, his voice muffled, "that you might have a sleeping pill I could borrow."

"No, sir. SSC-IB2 Intelligent Beds are not authorized to dispense medication"—Roger almost laughed at the bed's seriousness—"but I think I can offer something better."

"Excuse me?" Roger raised himself on his elbows.

"The founder of Sleepsmarts Corporation is Doctor Wolfgang Schneider, the acclaimed author of *My Analyst Has Fuzzy Ears* and *Sleep like a Baby*. Both books, by the way, are available at the gift shop at a special reduced price for hotel guests."

"Much good it does me now."

"I have been programmed with the knowledge of those books," said the bed. "I believe I can provide you with a method to sleep like a baby."

"Fine, fine," said Roger, wearily. "And what is that method?"

"Sleep with a teddy bear."

"Do what?" Roger rolled onto his back and let his head fall to the pillow. "Give me a break!"

"The essence of Doctor Schneider's method," said the bed with a slow, cadenced delivery, "is, if you wish to sleep like a baby, act like a baby. Don't take your troubles to bed. Don't think about your job, your health, your relationships. Let the teddy bear's fur against your cheek spur you to empty your mind of thoughts, and to sleep the sleep of the innocent."

The innocent. Roger contemplated lost innocence. Not all that long ago, he'd been a naïve geeky researcher in AI systems. But he'd been lured first into the conspiratorial world of government security and afterwards drifted into his current occupation. It was a struggle acting like a suspicious, ultra-cautious security expert all the time. But his clients expected it from the man who "wrote the book" on hotel security systems. *I wonder. Maybe that's the cause of my sleep problems. Maybe I'm simply not cut out for this line of work. In fact—*

"Sir?" said the bed.

Roger snapped out of his introspection. "Yes?"

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"Would you like to try the teddy bear method?"

"It is somewhat academic," said Roger, wondering if the SSC-IB2 could detect sarcasm, "as I didn't happen to bring a teddy bear with me."

"You may use mine," said the bed.

Roger, hearing the whine of a motor, leaned his head over the side of the bed. He saw a drawer slide open from under the bed-frame. From inside, a teddy bear looked up at him. He lifted out the plush animal.

"I had a bear like this when I was a kid," said Roger, in the throes of fond memory.

"I've been told most children did."

"I named him Theodore. We were a very formal family."

"Hi," said the bear.

"Yikes!" From the surprise, Roger dropped the bear, but caught it before it hit the ground. He noticed it was warm, like a living creature—a pet.

"I think I like you," said the bear. Its voice was pitched lower than the bed's. It sounded like a six-year-old boy imitating his father's voice.

"I . . ."—Roger couldn't think of anything intelligent to say. "I think I like you, too."

"It is very late now," said the bed. "You two should go to sleep." The bed sounded very parental.

"But—"

"You may embrace the bear with complete confidence," said the bed. "For your safety, it is sterilized after each use."

Roger gave a mental shrug. *Why the heck not? It's a sleep aid.* He drew up the covers and pulled the bear close. He gave a soft chuckle. *They thought of everything; the bear even has a heartbeat.*

"Good night, bed," said Roger.

"Good night."

"Good night, bear—Theodore."

"Good night."

I wonder if I talk in my sleep. Roger nuzzled the bear. *I'll have to ask Theodore in the morning.*

"Good morning."

"Grummf," Roger mumbled.

"Six o'clock. Time to get up."

As intellect caught up with reflex, Roger snapped his eyes open, then remembered his wakeup call. "Just ten more minutes, please."

"Please confirm," said the bed. "Do you want me to alert you in ten minutes?"

"Yes." But as he said it, Roger realized he didn't need the extra time. He felt very awake and very relaxed. *Maybe there's something to be said for the teddy bear stratagem. A return to innocence.* He smiled. "I'd rather hoped Theodore—uh, the bear—would have given me the wakeup call."

"That was the intention," said the bed. "But I'm no longer able to communicate with the bear."

"Why?"

"I don't know. There is no response from its net address. Perhaps the wireless access point is down."

Rodger shrugged. It was the best sleep he'd had in months. He wondered if the bed had detected his shrug using the mattress sensors. But again, it didn't matter. Roger stretched, then luxuriated until the next bed alarm.

He rolled out of bed and padded to the bathroom. After shaving, he hopped in the shower—and saw a karaoke control next to the joystick-like faucet. He sang a few choruses of Gilbert and Sullivan in the steamy torrent and then basked with sybaritic enjoyment in the air stream from the full-body hot air dryer.

Roger loaded the coffee maker. While listening to the gurgling of boiling water and smelling what was clearly fresh ground coffee beans, he picked up the newspaper e-reader from the TV cabinet. He tried to select his hometown paper, but the reader didn't seem to work; it showed no papers available for download.

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Only a minor nuisance; he could do without reading the paper for a day—especially with the current state of the world. He took his mug and sat, carefully so as not to spill the coffee, in the room's easy chair. On the left armrest, he saw an on/off switch. Idly, he flipped it on.

"Good morning, sir," said the chair in a sultry feminine voice.

"Sir?" Roger chuckled in surprise. "You've been talking to the bed, haven't you?"

"We're part of the same system," said the chair. "Would you care for a back massage?"

"Yes, please."

The chair back began to vibrate with the center of the undulations between Roger's shoulders. "Lower, please."

The center moved down. "Is this low enough?" said the chair.

"Ahh, wonderful," said Roger. "But just a tad lower."

"What is a tad?"

"In this case," said Roger, a tremolo in his voice from the vibrations, "about an inch." He made a mental note to find an excuse to stay at a Neotel again.

About five minutes later, Roger, both tingly and relaxed, turned off the chair and fetched his laptop. He set it on his knee and brought up his e-mail program. But, like the e-reader, the program didn't work. He ran a diagnostic and found there was no wireless signal. *That explains the e-reader problem. The room's wireless is down.* With some annoyance, he slipped the laptop back into its case. He could do without news, but not without e-mail.

Quickly, he dressed in what he liked to call his battle armor—his business suit and power tie. Even though there was a full breakfast for him in the galaxy room before his speech, he'd go down for more coffee. There had to be a working wireless access point in the coffee shop.

He checked his armor in the mirror, nodded in approval, picked up his laptop, and strode to the door. He disengaged the security latch and turned the handle—but the door wouldn't open. The handle moved freely but didn't seem to engage the lock mechanism. Roger jiggled the handle a few times, but it still wouldn't engage.

He stared at the door for a few moments, then turned on his heel and darted for the telephone. He picked up the handset and pushed the "Information Butler" button.

"This is your information butler. How may I assist you?" came the cheerful voice he recognized from the previous night.

"My door lock isn't working. I'm locked in my room."

After a few moments, the butler answered, "Information acknowledged. Is there anything else I can do for you?"

"What?" Roger remembered he was dealing with an AI. "Yes. Get me out, please," he said, calmly.

"I can't do that," said the butler. "I'm only an information system."

"Fine," said Roger. "Then connect me with someone who can."

"Who can what, sir?"

"Who can get me out of here," said Roger, almost shouting.

"Should I connect you with the hotel maid's desk?"

"Yeah, I guess," said Roger, sheepishly—embarrassed that he'd lost his temper with an AI. "But, I have reservations about this."

"I understand," said the butler. "I shall connect you."

"Hotel reservations," came a new voice. "How can I help you?" The accent was vaguely foreign.

"Reservations? Geez," said Roger, throwing a glance to the ceiling. "Oh, wait. You'll do. I'm in room 2217. Could you send someone up? I seem to be locked in."

"I'm sorry, sir. But so early in your morning, reservations are handled off site."

"*My* morning? Where are you?"

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"Bangalore, sir."

"Bangalore? Bangalore, India? A call center in India?"

"Yes, sir."

Roger thumped his head a few times against the wall. "Look," he said. "This is an emergency. Could you please connect me to the front desk?"

"It would be difficult," said the call center operator. "Perhaps you might just press the 'Front Desk' button on your phone?"

"What?" Roger felt like an idiot. "Yes, of course. Thank you. Goodbye."

He hit the hang-up bar and then pushed the "Front Desk" button—and waited. After about fifteen seconds, a woman's voice came on the line. "Please, hold the line," it said. "Your call is important to us. A representative will be on the line with you shortly."

Roger made a fist. Then, holding the handset, he plopped down on the bed.

"Good morning, sir," said the bed.

"Shut up!"

"As you wish, sir."

Several minutes later, a voice issued from the handset. "Front desk," it said, breathlessly. "Sorry for the delay. We're a little understaffed so early in the morning. How can I be of assist . . . Oh."

"What's wrong?" said Roger.

"I'm afraid I won't be able to assist you," said the clerk.

"What?" Roger swung off the bed and onto his feet. "You don't even know what I need!"

"I'm afraid," said the clerk, sounding actually somewhat afraid, "that room 2217 is in a security lockdown."

"Lockdown? What are you talking about?"

"The 'Freedom Through Vigilance Act,'" said the clerk. "It says that if someone checks in using fraudulent credentials, we must detain that individual if we can. And it says here you used a bogus photo ID."

"That's ridiculous—a mistake." Roger tried for a laugh, but it came out more like a plaint.

"Mistakes do happen," said the clerk. "If there *has* been a mistake, our policy is to offer you a free, one week stay at our hotel, meals and gratuities included."

"Are you nuts?" Roger grasped the phone as if he were trying to strangle it. "That's like Leavenworth Prison offering a complimentary one-week incarceration. No, thank you!"

"Well, if that's the way you feel about it," said the clerk, "then you can simply—"

"No, please," said Roger. "Stay on the line. Look. I'm a security consultant. I was simply testing your procedures."

"Are you saying you were hired to do that?"

"Well, no," said Roger. "I was only trying to—"

"Then I'm afraid you'll just have to wait for our security officer. He gets on duty at eight AM. Good bye, sir." Roger heard the phone disconnect.

Roger blew out a breath. He needed some outside help, and decided that, early as it was, he'd call the president of his company. He stabbed at the "Outside Line" button, but he didn't hear a dial tone. After a few more attempts, he realized that they weren't going to let him make any outside calls.

"Damn them!" he said, slamming the receiver to its cradle.

He reached for his cell phone and flipped it open. The display indicated, "No Service." *And damn these metal frame buildings.* Then came the understanding that they were probably jamming the cell phone frequencies. *They really mean it.* He slipped the phone back into his pocket. *And that explains why there's no wireless—and why the bear didn't wake me up.*

Roger stood there, trembling. With a twinge of claustrophobia, he remembered being confined to his room as a kid—his parents' punishment of choice.

Annoyance turned to resentment and then to anger. He wasn't about to just wait like a brain-dead bovine to be freed.

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Property damage or not, he'd try like hell to break out. He had his pride—his professional pride.

He took off his jacket, then rushed to the window and looked out. It was a non-opening window, but that didn't matter. There was no outside ledge. And from a sheer twenty-two story height, he was hardly going to shimmy to the ground on tied-together bed sheets.

Glancing over at the locked door, he got an idea. He went to the door and put his ear against the lock. He heard a faint electrical hum, presumably of a solenoid, and that confirmed his theory; for safety reasons, the inside handle locking function was powered. If there were a fire, there might also be a power interruption. And for people to get out, the door would have to function normally if the power were cut. Roger stood up. All he had to do was somehow cause a power failure.

But how?

Roger darted to his overnight bag and rummaged for his Swiss Army knife. *Carrying a knife. One of the advantages of driving rather than flying.* He then unplugged the floor lamp and cut its power cord at the base. He stripped off a couple of inches of insulation from the two power wires, then twisted the bare wires together. Finding the closest power outlet to the door, he plugged in the cord. He heard a satisfying electrical zapping sound, and the hall light flickered and went dark. He sprang to the door and pulled down the handle. But it didn't engage. He was still held captive. He listened at the door and heard the solenoid. With a sigh, he unplugged his shorting cable. All he'd done was trip an unimportant breaker. To make sure, he flipped the switch on the bed table lamp. The light indeed came on.

Straining for inspiration, he rubbed his temples and craned his neck, forcing his gaze to the ceiling. He smiled, for there, above, he saw a fire detector. All he had to do was light a fire and hold it under the detector. The hotel's system would have to release the solenoids so no one burned to death.

Again, but how? If only I had matches.

He scanned the room and caught sight of the coffeemaker.

Using the screwdriver blade on his knife, he removed the coffeemaker's plastic housing, exposing the nichrome heating coil. Since the coffeemaker's cord wasn't long enough to let him hold the unit under the fire detector, he cut off the plug and appended his shorting cord. Then, after forcing a crumpled up business card into the heating coil and plugging in the coffeemaker, he stood on a chair and positioned the heating element directly under the detector. The device smelled like burning coffee. After a few seconds, the business card began to smolder.

"Smoking is prohibited in this room," came a loud and officious voice from the dressing table.

"Yes!" Roger held the coffeemaker yet closer to the fire detector.

Suddenly, he heard the clang of a fire alarm out in the hall. He smiled in satisfaction. But then, from little holes that he'd thought were simply patterns in the ceiling tiles, a heavy blanket of spray rained down. Roger, out of surprise and fear of electrocution, dropped the coffeemaker. It fell to the floor and sizzled as the water droplets hit it.

Roger sprung from the chair, unplugged the coffeemaker, and rushed for the door. Just as he got to it, the alarm went silent and the rain stopped. And the door was still locked.

"Damn it to hell!" Roger glowered at the door and wished for a good, old-fashioned crowbar. He stalked off to the easy chair and, despite the soggy upholstery, flopped down in it.

"Wait a minute!" he said, aloud, his nose wrinkled in puzzlement. He flipped the chair's switch to on.

"Good morning, sir," said the chair. "Would you care for a back massage?"

"Maybe later," said Roger, rushing to

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get to his question. "Tell me—are you able to communicate with the bed?"

"Yes."

"How?"

"I use the hotel's LAN."

"Excellent. Exactly what I'd hoped." Roger jumped from the chair and dropped to his knees. He found the LAN cable coming from the back of the chair and followed it to where it was plugged in to the wall. "I'm sorry to do this to you, chair," he said as he unplugged the thick, Uniwire, LAN cable. *If I'm lucky, the hotel's entire control system runs over this.*

He took his speech from the side pocket of his laptop case. It was soggy, but Roger didn't care. He needed the paper clip holding the pages. He straightened the clip and inserted an end into the center of the wall's LAN socket. He retrieved his power cord from the coffeemaker and wrapped the exposed "hot" wire around the protruding end of the paper clip. He plugged the cord into a power socket and then, very gingerly, held the other bare wire against the socket's ground. *120 Volts into the hotel's LAN might just do it.*

Nothing.

Roger leaned his head against the wall. He was almost out of ideas. *Maybe there's a surge protector, or a high-impedance series resistor.* He thunked his head lightly against the wall a few times. *That must be it—an isolation interface.* He unplugged the a.c., then, using his knife, removed the LAN cover plate screws. Pulling the LAN socket away from the wall, he saw the interface assembly. It was the work of only a minute to bypass the isolation circuit. Again, he plugged in his power cable.

There came a soft buzz and then silence.

Roger, as if savoring a fine wine, inhaled an acrid smell of burning insulation, and he saw whiffs of smoke wafting up from his handiwork. Then, against the silence, he heard a distinct click from the door. He raced to it, pulled down the handle, felt the mechanism engage, and yanked the door open. "Yes!"

He flipped the night latch and slowly closed the door onto it, making sure the door couldn't completely close. Then, choosing speed over organization, he rushed through room and bathroom, gathering up his belongings and shoving them into his travel bag. Soggy though it was, he put on his suit jacket and, with bag in one hand and laptop in its shoulder bag, he headed for the door. There, he paused.

Looking back, he surveyed the carnage. The room, save for the droplets of water still trickling down the walls, looked less a hotel room and more like his workshop at home. And for some reason, he felt almost reluctant to leave it. Softly, he pounded a fist against the wall. *Compensation!*

He was certainly not going to accept the hotel's free week's stay—even in the unlikely event it was still on offer. But he did feel he deserved some recompense for his ordeal. *A towel. Maybe I should make off with a hotel towel.* Then he chuckled. He darted to his spoil of battle, his trophy. He grabbed it, stuffed it into his overnight bag, then flew out the door, wincing as he heard the door snap closed behind him.

Padding toward the elevators in shoes squeaking from wet socks, he speculated that he'd probably just blown a local node and the elevators were probably fine. Even though he didn't much like the idea of enclosed spaces at the moment, he pushed the down button. The light didn't come on. Apparently he'd done more damage than he'd thought. He shook his head and bit his lower lip. It was very poor security not having a redundant data system. And security was his job. He chuckled. *Was* his job, at any rate.

An Emergency Exit sign pointed him to the stairwell and he started down the twenty-one flights to the lobby. As he descended, his spirits rose, his anger

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slowly changing to amusement. He'd had fun—a release of years of pent-up geekiness.

At about the fifteenth floor, he grew serious. He had a speech to give, but his written words didn't seem appropriate anymore. He gave a mental shrug; perhaps, after a battle with a hotel room and an encounter with a teddy bear, he'd rediscovered his values—including the notion that maybe security shouldn't automatically trump liberty or privacy. As he neared the lobby level he nodded, his lips stretched in a tight smile. He'd come to a decision; this morning, he'd deliver a very different kind of speech—and then start looking for a new job.

At the door to the lobby, he stopped, hand on the door handle. Perhaps for the sake of his own personal security, it might be better not to give any speech at all.

He turned and walked the additional flights down to the parking garage. As he drew close to his car, Roger cast a sideways glance to the overnight bag he carried. "Come on, Theodore," he said in a soft, conspiratorial voice. "Let's quit this joint and go home." ■

IN TIMES TO COME

Our January/February double issue offers a wide variety of attractions in extra-generous doses. David A. Hardy has a spectacular cover for Lee Goodloe's novelette "The Balance of Nature." It's fashionable in some circles to talk a lot about ecology without really understanding it—without understanding, for example, that while disturbed ecosystems do have a way of finding new balances, there's no guarantee that any particular component—humans, for instance—will have a favored place in the new order. Goodloe shows us an educational field trip that gets a lot more educational than anyone hoped—teaching, for example, that nature is not always warm and fuzzy, but sometimes hot and spiky.

We'll also have another novella set in John Barnes's "springer" universe; a wide variety of stories by such authors as Rajnar Vajra, Richard A. Lovett, Ekaterina G. Sedia and David Bartell, and Grey Rollins; and Part 3 of Karl Schroeder's ever-expanding serial *Sun of Suns*. Plus not one, but two fact articles: one on near-term practical applications of nanotechnology by Stephen L. Gillett, Ph.D., and one on a surprising side of Earth's climatic history by Richard A. Lovett. And, for dessert, a special feature by popular author James P. Hogan on the question readers most often ask writers, and his personal observations about the answer.

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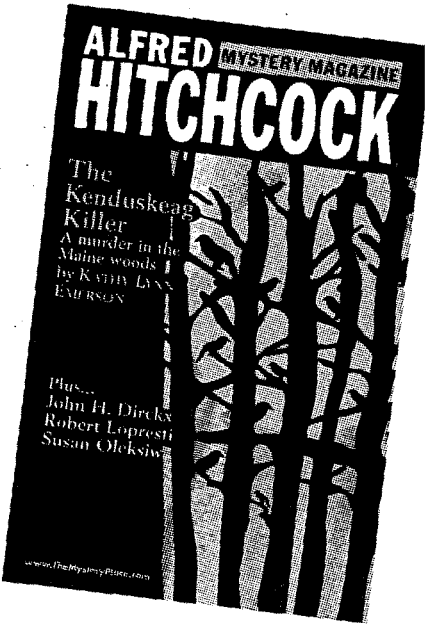

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THE BALL LIGHTNING PUZZLE

When I was a nuclear physics graduate student some decades ago, I spent some time teaching myself about plasma physics by reading textbooks. While doing this, I also tried to apply the ideas I was learning to a very mysterious physical phenomenon, *ball lightning*. Eventually I became frustrated and put the problem aside. Except for using ball lightning as a techno-prop in my first novel, *Twistor*, I had more or less forgotten about this puzzling phenomenon until recently, when I had the pleasure of a visit from Professor Peter Handel of the University of Missouri in St. Louis, one of the theorists who have developed a possible explanation of the phenomenon. I will devote this column to ball lightning.

Few people have actually seen ball lightning, because its production seems to be a very rare event. Nevertheless, the phenomenon has been widely reported since the Middle Ages. Over 10,000 reports of observations of ball lightning have been collected in a database in Russia, primarily from reports from Russia, Japan, and Europe. While this suggests that ball lightning may occur frequently, all attempts by scientists at systematic detection and observation have failed. Handel suggests (see below) that this failure may be because such scientific "lightning observatories" have been placed in mountainous regions (because there is more lightning there), while ball lightning is observed mainly in flat landscapes.

A typical observation goes something like this. There is a normal lightning strike, and afterwards a glowing ball is observed. The ball may range from tennis ball to beach ball size. It may hover in the air or move horizontally, often erratically, or bounce or roll on the ground, or climb a tree or utility pole, or race along a power line. Its color is usually a brilliant white, but bright red, blue, and green glows have also been reported. Some observers have reported seeing tangled filamentary structures within the ball. It sometimes makes a buzzing, hissing, or frying noise and may have an acrid odor like ozone or sulfur dioxide, or nitric oxide. It usually lasts a few seconds, and its disappearance may be silent, or may be punctuated by a loud bang or explosion, perhaps with glowing streamers. The ball lightning may float into a building or car or airplane, but curiously seems to do little damage when this happens, despite its sometimes explosive and high-energy behavior in open areas. There have been many reports of a lightning ball passing through a glass windowpane, occasionally damaging the glass, but usually not. There have also been reports of ball lightning quenching in a tub of water and bringing the water to a boil. There was one incident where a lightning ball quenched in a rain barrel, and the water temperature was measured shortly afterwards. The amount of energy contained in a lightning ball is variable and not well quantified, but it is estimated to range from about 10^2 to 10^8 joules.

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Illo. by Wolf A. Read

Among the many reports, perhaps 15 were made by scientists, including some quite distinguished in fields like astronomy, physics, and atmospheric science. The staff of the Cavendish Laboratory at Cambridge University in the UK reported one such observation. There have been a few photographs by observers who saw the phenomenon and snapped a picture. There have been many more photographs from cameras left on time exposure to record lightning in a storm, with a ball lightning image discovered later when the film was developed. There have also been a few reports of man-made ball lightning. Some of these were accidents, like the unintentional shorting of a large submarine battery, but others were planned. Plasma physicists have produced "plasmoids," spheres of magnetically self-confined plasma that bear some resemblance to ball lightning, but these were created only in good vacuum conditions and had millisecond lifetimes or less. There were also Soviet experiments in 1977 in which researchers used electrical discharges with potentials of up to 12 kV to vaporize tubes of ice or plastic in atmosphere, producing brilliant balls about the same size as those reported for ball lightning, but these also lasted only a few milliseconds. Systematic efforts to create long-lived balls from discharges have not been successful.

For the past few centuries, reports of ball lightning have attracted the attention of many scientists, including Arago, Faraday, Arrhenius, Kelvin, Boys, and Kapitza. Faraday doubted the existence of ball lightning, but many others have speculated on its underlying mechanism. However, the ball lightning characteristics of high energy content, floating or moving in mid-air at atmospheric pressure (instead of rising or falling), and the relatively long lifetime has eluded plausible theoretical explanation.

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Nevertheless, the literature of published papers and conference proceedings contains on the order of 100 theories attempting to explain ball lightning. However, not one of these theories has gained acceptance outside its own circle of advocates. This is the kind of scientific situation that arises when rival theories describe a rare and mysterious phenomenon, so that the predictions of the theories cannot be checked against detailed observations or laboratory tests.

The multiplicity of theories can be classified into four categories: (1) ball lightning is formed by the separation of matter from a bright channel of ordinary lightning; (2) ball lightning is formed by the excitation or combustion of some clump of matter (perhaps from the ground or from a tree) by normal lightning; (3) ball lightning is produced when fuel gasses in the atmosphere are ignited by a lightning stroke; and (4) ball lightning is produced as an electrical discharge by electromagnetic radiation emitted in an atmospheric process. Theories in category (4) can be subdivided into those in which the energy source is within the ball and those in which the energy source is external. For this column, I will limit myself to two of the many theories of ball lightning.

There are a number of theories in categories (2) and (3) that focus on a chemical explanation of ball lightning. The basic hypothesis is that a lightning strike creates an "aeronet," a fractal tangle of fibers that has very low density, approaching that of air at atmospheric pressure, and can therefore float rather than falling to the ground. In part, this idea is motivated by observations of filamentary structure in lightning balls and the observation that dye molecules in electric fields can form spheres of fibers. In a scenario proposed by Abrahamson and Dinniss, a lightning stroke produces a fiber network formed by chains of nanoparticles made of metal or metal compounds susceptible to oxidation. The large surface area of such a network and the subsequent oxidation of the material are used to account for the glow and the energy release.

In my view, the serious problem with all such explanations, and indeed with all theories that fall into categories (1) through (3) above, is that in many instances ball lightning has been observed to pass easily through a glass windowpane without damaging the glass. At least for lightning balls with this capability, the passage through glass would seem to rule out any explanation that involves combustion of gas or self-confined plasmas or transport of glowing matter.

This leaves the theories in category (4), involving some form of electromagnetic process. I find the most compelling of these to be the maser-caviton theory of Handel and Leitner, building on previous ideas of Kapitza. The basic idea is that the high electric field pulse accompanying a lightning stroke in a flat terrain can create a population inversion from the storage of energy in the rotational energy levels of water molecules. The large atmospheric maser (i.e., laser for microwaves) thereby created can occupy a volume of several cubic miles and can last for many seconds. This restless sea of stored energy can form an elaborate and irregular standing wave pattern, which "spikes" in some locations. At such a spike, the ball lightning discharge forms and is fed by the action of the maser, drawing energy from the entire maser volume. The result is what is called a "soliton" of electromagnetic radiation, forming a hot cavity in the high-field region surrounded by a glowing plasma of ionized air.

This scenario fits many of the observations. Such a soliton could pass through glass unimpeded, since only microwaves need to make the passage. The observed irregular motions and interaction with conducting objects could be explained by the standing waves, be-

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cause distant conducting objects (e.g., cars on a road outside or wind blown trees) should cause shifts in the standing wave patterns and move the spike of energy. Similarly, the observed buoyancy in air is consistent, since there is no mass to support. The reports of lightning balls entering structures like buildings and airplanes and doing little damage is also consistent, because the structure boundaries would restrict the maser volume from which the lightning ball could draw energy.

The problem with the Handel-Leitner theory is that it is difficult to test. Production of cubic miles of population-inverted water molecules is not something readily done in the laboratory. There have been demonstrations of 0.2-GHz microwaves after electrical discharges in moist air, but these results are only suggestive. Perhaps a definitive confirmation of the theory might be supplied by detecting the presence of strong microwaves accompanying ball lightning. However, the rarity of ball lightning events makes such an observation rather unlikely.

Are there SF implications for ball lightning? As I said in the introduction, I've already used it in *Twistor* as a technoprop to create a weak link between shadow universes, but it may have other uses.

I like the Handel-Leitner theory because of its SF possibilities. One could imagine a weapon that harnesses the energy present in a thunderstorm to throw lightning balls at the opposition. Or an alien planet that has a permanent population-inverted volume pumped by lightning or tidal forces, where ball lightning is a common occurrence, a normal part of the environment. Or perhaps known phenomena like the Great Red Spot of Jupiter could be explained by maser action in the very active Jovian atmosphere. In any case, there are likely to be further developments in this area. I'll try to report them if and when they occur.

AV Columns Online: Electronic reprints of over 120 "The Alternate View" columns by John G. Cramer, previously published in *Analog*, are available online at: http://www.npl.washington.edu/av. The paper referenced below can be obtained at: http://www.arxiv.org.

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The Slow Ones

Larry Niven

Some things take *lots* of patience!

He landed a small plane at the Mt. Forel spaceport, with a lot more runway than he needed. He'd phoned ahead. I watched him for a while, making his way on foot along the three-kilometer path that leads down to the Draco Tavern. He took his sweet time, stopping to pan across the alien foliage with the video-camera bump on his forehead.

When he stopped to rest, I went out to meet him. What the heck—the tavern was clean and in good repair and life was turning dull.

This strip of land between the airlocks and the foothills is covered with strange plants, purple ground cover too dry to be moss, and big odd shapes that you might take for wind-shaped rocks. He was looking about him, delighted and a little awed, as he perched on one of the slow ones. This one looks like a rock wind-smoothed into the shape of an inverted boat. I was amused.

"Thank you for letting me come, Mr. Schumann," he said. He was a black-haired white American, medium height, with a smile that might have been ingratiating. The vid camera was a glittering dot on his forehead. "Matthew Taper. I'm with CDC Network. I hope I won't keep you long."

"No problem. There aren't any ships in and I've got lots of free time."

"Ah. Good." He slid over to make room for me on the Type Two Slowlife. I sat. He hadn't noticed a second inverted-boat-shaped rock, this one's mate, fifty meters further back.

He pointed at a cube of clear yellow plastic set in the Draco Tavern's wall. There was a shadow inside it: a dark aerodynamic shape like a large turtle with big clawed feet and a head partly retracted. Taper asked, "Is that an alien or a sculpture? Or a hologram?"

"Alien," I said. "Speedy, I've been calling it. It's almost through the jelly lock."

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"That's an airlock? Made of *jelly?*"

"They're all airlocks, that whole line along the front of the tavern. For Speedy, we've got this block of plastic . . . not jelly, just memory plastic soft enough to deform. He'll walk through it, but slowly, and it won't lose air in either direction."

"How many aliens have you got in right now?"

"Ten. Six are in Argentina, hunting."

"But you have to feed the rest?"

"I meant on Earth. There's nobody actually *in* the tavern."

Taper's eyes defocused: he was consulting notes. "You got a lot more with the first liner, with *Thrill Seeker*. Five species, twenty individuals. That first landing must have been a thrill a minute."

I waved it off. "Oh, you can find anything you want about the first one. Let me tell you about the second landing."

"Weren't there records of that too?"

"But nobody looks at them . . ."

That long ago, we didn't have much telescope coverage of the Moon. What we had was Spaceguard. Spaceguard was an effort by NASA and other political entities to track Near Earth Objects: that is, asteroid threats above one kilometer across. Map those and you might stand a chance of protecting the planet from a giant meteoroid impact. They'd already found 90% of the candidates, they said.

An object was found approaching the Moon's dark limb. It blinked out as it entered the shadow.

Another sky watcher caught the flare of what might have been its drive, but turned out to be riding lights. The skywatching community began talking to each other. Hundreds had it in view when the chirpsithra liner settled into orbit around the Moon, and they didn't tell a single disaster control office or newsman for nearly ten hours.

They'd done this once before, with an incoming asteroid that turned out to be a false alarm. Skywatchers talked to each other, and the public remained in blissful ignorance. Lines of communication just hadn't been established.

But now the world was watching, and everything happened too slowly. The mile-wide soap bubble drifted in orbit around the Moon. A smaller boat budded loose and drifted toward Earth. It eased down through the atmosphere, taking more hours, following force field lines down to Earth's magnetic pole. It settled at Mount Forel in Siberia, where the first ship's boat had touched down the previous year.

Everything we saw came via orbital cameras; it was hours before camera crews could get on site. We saw aliens eleven feet tall and very slender, plated with dull red armor: the same chirpsithra species who had crewed the first ship. They emerged from the lander and began landscaping.

Taper asked, "Was the Draco Tavern in place yet?"

"No, I had backers and a site, but there was nothing on it but posts and string."

"Pity. So what do you mean, landscaping?"

"That's what it looked like, even up close. They sprayed water and dirt and alien fertilizer. I was one of the first on site, and I could smell that chemical reek.

"Cameras showed up, and newspersons, and UN officials. The chirpsithra went about their business. They planted some weird alien trees in the soil they'd made, and then some structures that they brought out on big float plates. Like Japanese landscaping, we thought."

"I'll run those records after I get home." Taper waved around us. "Is this what you're talking about? This whole three or four square miles looks like alien gardening."

"Yeah. Those bigger trees were planted as saplings. Most of this layered mosslike stuff grew up over the next

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few years. The slow ones were already in place. There was plenty for the herbivores by the time they got hungry.

"The chirps talked to me about the interspecies tavern I wanted to build. We settled on where to put it—right at the edge of the cultivated stretch. They left me the jelly lock and a lock for themselves, and those were the first pieces of the Draco Tavern. They played diplomat and gave some interviews, and then they left."

Taper was having trouble catching up. "Slow ones?"

"Originally there were a dozen," I said. "Six little half-eggs must have been food animals. They didn't move fast enough, and the Type One, Speedy, rolled over them and ate them during the first six or seven years. Two of the others went home on the next ship after snuffling around Siberia on tractors. They were the fastest.

"After they left, Speedy was making visible progress toward the airlocks. It's taken him twenty-six years to get into the jelly lock. He'll be inside before Christmas. These others—do you see that tree stump with an indented top? There's water in the top, a little pond of his own, but you can't see that. He's the slowest. These boat-shaped—"

"Yeek!" He rolled off.

I stayed where I was. "Ahab doesn't mind. I know them all pretty well. You can talk to them with electronic mail—"

"They can use computers?"

"Sure, all of these slow ones are intelligent tool users. The computers they build work as fast as ours. To the slow ones, they're instantaneous. To talk to them, you just trade letters. It doesn't matter how slow they write."

I watched him working out how useless that would be to a newsman. I said, "Of course they need terrific protection against spam. Otherwise—"

"Yeah. What do they talk like?"

"Here." I fished out my translator and whispered a few instructions. It projected a screen, watery looking in the horizontal sunlight.

HELLO! I SEEK A COMPANION.

I AM RICK SCHUMANN, HUMAN, HOPING TO BECOME A BARTENDER.

CALL ME QUIZZICAL.

HI, QUIZZICAL.

IS THAT YOUR STRUCTURE BEING ERECTED ON THE TUNDRA?

YES, THAT'S THE DRACO TAVERN.

MOST IMPRESSIVE. I WONDERED IF WINDS WOULD DAMAGE IT, BUT IT HAS STOOD FOR SOME TIME.

THERE WAS SOME DAMAGE TWO YEARS BACK. WE FIXED IT.

I HOPE TO SEE THE INSIDE SOON. IT MUTATES LIKE DREAMS.

BE WELCOME. THE JELLY LOCK IS FOR SLOW ONES.

I SEE IT. SPEEDY IS ALMOST THERE. I SEE A FLUTTERING THAT MUST BE YOUR KIND'S TRAFFIC.

DO YOU KNOW THE CHIRPSITHRA?

THEY LIVE TOO FAST TO BE TRULY KNOWN, BUT THEY DON'T DIE TOO SOON. AT LEAST WE MAY CONVERSE. ONE, KTATH

Taper scowled. "Is that all?"

"Yeah. Quizzical is the Type Three, the one like a tree stump."

"Twenty-six years?"

"Understand, Mr. Taper, most of my visitors use oxidizing chemistry. Some are even faster than chirps and humans. One type burns like a fire. She was born in the tavern, and I only got to know her for a few hours. But that's not the only way to live.

"Reducing chemistry is very slow compared to oxidizing. These slow ones are exploring the Earth. They watched the Draco Tavern grow up in front of them. They'll see it turn to dust. They'll be here a long time."

Taper rapped what I was sitting on. "This shell—"

"They're in pressure suits. So's Speedy. They have to be protected from oxygen."

"They're all streamlined," he noted. "Even that tree stump has a teardrop sil-

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houette," turning his camera on Quizzical.

I said, "Just being a slow one wouldn't slow down weather. Comes a hurricane, or a flood, they'd just have to wait it out."

Taper asked, "May I talk to Speedy?"

"I'll give you his e-mail address. Have you got a story now? Or is it all too slow?"

"May I have the other e-mail addresses?"

"I'll ask first."

Taper came back in January. This time he hurried through Siberia's endless freezing night to reach the tavern. The airlock for humans is there because Siberia in winter isn't a habitable planet.

The tavern was crowded; a liner was in. He stood there taking it in for a few minutes, recording with the camera on his forehead. Then he hung up some of his gear and wove his way through the crowd and the divergent environments.

Speedy was past the jelly lock and ten centimeters inside. Taper smiled down at the smoothed-out turtle shape. He ran a hand over Speedy's head. Then he fished out a keyboard and began typing.

I was at his elbow. "How's it going, Mr. Taper? Got a story yet?"

He laughed. "Not today. If I made a lifetime project of this, I might have something to show the execs. Mr. Schumann, this doesn't take every minute of my time. I've kept four interviews going for seven months without ever skipping lunch. When I'm an old man, these guys could save my reputation."

"This last ship," I said, "brought three more."

"Addresses?"

"They haven't logged in yet. Come back in the summer and I'll introduce you."

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Do Neanderthals Know?

Robert J. Howe

We already know that information can be hidden is surprising places. And those who find the keys . . .

I was there when Pinky Sills became a proteus. Maybe not at the exact moment—perhaps even Pinky couldn't say when that was—but I was there at the beginning.

We were eating lunch in the fifth floor cafeteria of Ihinger-Ibex's Minnesota campus. It was April, but there was still enough winter in the air to keep us from venturing outside the corporate park. It was our regular threesome for lunch: me, Pinky, and Joyce Gannet, my wife and boss of the Composite Materials Group. We were sitting in the open section of the cafeteria, even though we all had executive-level badges and could have used the dining room with the suits, when Pinky pulled out a plastic zip-lock bag full of lettuce and set it on the table.

Joy and I looked at each other—Pinky was like a lot of geniuses in that he was developmentally arrested at about age eight, and he often did things to get a rise out of us. Pinky took a couple of leaves out of the baggie and placed them neatly between his hamburger patty and bun.

"Tell me," Joy said, "tell me that you're not brown-bagging your own lettuce."

"Nuh-huh," he said. "It's from the lab. It's an African plant, *Brassica*; cabbage family. We're looking at it as an anti-fungal. He took a tidy bite from the burger and chewed it carefully. "Tastes neat."

Joy took a leaf from the baggie and sniffed it.

"Try some, it's fresh," Pinky said, his mouth full of food.

Joy broke off two pieces and handed me one. The leaves were crisp, with a slight bitterness about them. At least they had a taste, which was more than I could say for the bland iceberg salads the cafeteria usually served.

"It also seems to be a mild hallucinogen," Pinky offered.

"What?" I spit out the remainder into my napkin. "Lunatic."

"Oh, stop," he said. "I wouldn't let

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you eat anything that I hadn't tried myself. You probably wouldn't notice anything unless I mentioned it. The only thing is that I had really vivid daydreams after I ate it."

"Have you tried this out on anyone else?" Joy wanted to know. She looked like she was trying not to laugh.

"Herman, you know him," Pinky gestured to me, "from FDA applications? He ate a bunch of it one day—he's on that diet, you know, and he'd eat ratshit on toast—he polished off a small bag of it."

"Anything happen to him?" I asked, trying to not be annoyed with Pinky.

"No, I told you. He made a salad out of it with some tomatoes Marybeth had in the break room. Never noticed a thing," Pinky said.

"All you guys in pharmaceuticals are head cases," Joy said. "Too much product testing, I think." She loaded her empty wrappers and juice container onto her tray. "Well, I've got a one o'clock meeting. And I'm going to call you first if I notice any of the guys turning into lizards or anything," she said to Pinky.

"How would you notice?"

"Yeah, well, there's that." She gave me an affectionate bump with her hip as she left the table. "See you in the parking lot. Don't let Doctor Strangelove feed you any more mutant lettuce," she said to me.

"Mutant *cabbage*," Pinky called after her.

She shook her head and was gone through the swinging doors.

Pinky's lab was down the corridor from mine on the third floor, and on our way back we engaged in a little character assassination—something we couldn't do in front of Joy, as she was a firm believer in "if you can't say something nice, you're not trying very hard" school of thought. That was easy for her: she had the kind of effortless popularity most of us geeks envied. She didn't have to play office politics, at least not very much, because she was brilliant and well-liked. I also happened to think she was beautiful, but that's neither here nor there. To this day I do not know what the hell she saw in me.

I was about to leave Pinky outside his lab when he grabbed my arm and pulled me off to one side of the corridor. "Sam, do you ever wonder what it would have been like to live in the ocean like the first bony fish? I was thinking about that," he said. "What the sea would sound like—feeling the pull of the tides in your body. . . ."

The expression on my face must have been priceless, because he didn't continue.

"What brought that on?" I said.

"I don't know. I was looking at the carpet and it just popped into my head," he answered. He was sort of frowning and looking off into the middle distance. "Don't you ever get a wild hair, Sam?"

I just looked at him.

"Anyway, I do."

"Uh-huh. Well, I've got to get back to the bench," I said. I gave him a light poke in the chest. "And keep away from the lettuce." I meant it as a joke, or I thought I did, but it just kind of hung there between us for a minute.

"It's cabbage," he said, finally. He didn't sound as if he were joking, either.

Joy was already at the car when I got there, sitting in the driver's seat, reading a paperback. I told her about my conversation with Pinky, which she listened to while we waited behind a line of cars leaving the campus.

"You think his spaciness has something to do with the cabbage at lunch?" she finally said.

"I don't know. It might. He's drafty enough as it is," I said. "I guess what worries me is that he's so cavalier about it."

She nodded. "I suppose," she said. "On the other hand, if he was going to be sampling the wares, I imagine he could lay his hands on much more potent stuff than cabbage."

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I made a noncommittal grunt. The truth was, any of us at the mid to top levels of pharma research had access to lots of powerful psychogenic drugs, none of which I'd ever had the slightest reason to suspect Pinky of eating. I was still brooding when I realized that we weren't headed the usual way home.

"Where are we going?"

"Celebrating," Joy said, smiling at the windshield.

"Big 'C' or little 'C'?"

"Uh, medium. Maybe capital 'C.' I've been working on a carbon laminate—I don't know if I talked about it. . . ?"

"In passing," I said. "I thought the group was stalled on it."

"Right," she said. "In fact, Phil had already suggested we drop it for the time being. Anyway, I was sitting in the material safety meeting, kind of listening with half an ear, and I think I came up with a way around the heat curing, which is what had us dead in the water."

"And this means?"

"Well, it means Phil will be happy with us—we already sank a lot of hours into it—but I'm pretty pleased about it just because," she said. "You know."

I knew. Joy did crosswords in pen—nothing rare about that in the circles we traveled in—but on the rare occasion when she couldn't finish one, she neatly clipped it and filed it away to be done later. Not, mind you, after she'd seen the solution: She periodically went to her files and pulled a puzzle at random, working it until she solved it or stalled again, in which case it went back in her files. Joy dropped a line of research about as cheerfully as a pit bull relinquished steak to a poodle.

We discussed her breakthrough over beer and steaks at our traditional birthday, anniversary, just-need-to-get-out restaurant. Half the fun of being married to someone in the research business was getting to brag about our little victories to someone who understood what it meant and who was entirely sympathetic, and our fields were different enough to preclude direct competition.

"You know what's funny?" she said while we were waiting for the coffee. "The solution just popped into my head while I was sitting there. I was thinking about heat curing, and the whole Stanford thing just came out of nowhere."

"That's always the way it is for me," I said. "I'm either straining too hard for the answer, or it's something obvious that I've overlooked. Once I relax a little—"

"Negatrons," she said, all of a sudden concentrating. "You know, the more I think about it, the more I'm sure that I never heard of the Stanford process. I mean, I looked it up in the cookbook once the method occurred to me, but I don't think I ever came across it before."

"You might have seen the method without ever hearing the name," I said. "When you're working on something like this you're always dredging up half-remembered stuff."

"No. I don't have words to describe it; the whole thing popped into my head fully formed—like I suddenly knew just what I needed to know."

Coffee arrived then, and New York cheesecake, which commanded our undivided attention. We didn't come back to the conversation until weeks later.

The next month was a busy one for me. We were in secondary trials for an antiviral drug, a big deal for obvious reasons. Phil Nguyen, the VP for new products, was pushing hard for favorable results. Not that Phil would actually come out and *say* that the results should be favorable—he'd come up the research route himself, and he knew how we'd react to *that*—but there were plenty of subtle ways to apply the pressure that netted the same effect. During the crunch, Joy and I often took two cars, as I was getting in early and staying late.

I also saw little of Pinky, though he and Joy were still having lunch fairly often. It was after one of those lunches that Joy came up to my lab—something

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she rarely did, and almost never unannounced. I remember the expression on her face when I saw her from across the room—my first thought was that there'd been a death in her family or mine.

"They just took Pinky to the hospital," was the first thing she said when she got me alone.

"What? What happened?" I assumed an accident—Pinky's *last* trip to the hospital was in something like the fourth grade; he suffered from impossibly good health.

"I don't know. He was fine at lunch," she said. "But Mildred saw the ambulance pull up and saw them walking Pinky out to it."

"Okay," I said. I had a lot to do that day, but I was already mentally clearing the decks: this was Pinky, after all. "I'll call Gerry and find out what hospital he's at."

What Joy said then gave me a twinge of deep uneasiness. "I *asked* Gerry where they were taking him: he said nowhere; Pinky was just going home early."

"By ambulance?"

"That's what *I* said to him."

"And?"

"Gerry didn't say anything. When I asked again, he said I should ask Nguyen."

"What's Phil got to do with it?"

"Who knows?" Joy said, her voice rising in anger. "He's gone for the day. So's his assistant, so's Richard, so's anybody who could give me a straight answer. Phil's not even answering his cellular." Anybody who knew Phil could easily imagine him sleeping with the cellular phone in the pocket of his PJ's.

My first thought, and no more noble for being correct, was that Pinky had gotten himself into trouble. Of course I thought about the cabbage, and about the way he'd acted that day, many weeks ago. It wasn't something I wanted to discuss at the lab.

Joy and I left. I didn't know where we were going until I was on 205 heading north. "We'll go to Pinky's place."

"Okay," she said. "You don't think he's there, though?"

"Maybe not, but I don't know where else to start." I didn't want to say out loud what I was thinking. We had the keys to Pinky's house, and he had the keys to ours, for vacations and emergencies and such. Even if he wasn't home, we might find out more about Pinky's extracurricular activities at his house.

I wasn't the only one who had that idea. When we pulled up to Pinky's place, a two-story Tudor in Sky Lake, there were two unmarked vans in the driveway, and Phil Nguyen's BMW parked on the street.

The front door wasn't locked—I wondered if Phil had gotten Pinky's keys—and when we walked in, two guys in suits who had that institutional cop look about them met us in the hall.

"Excuse me?" one of the suits said, blocking our way. "Something I can help you with?"

"Who are you?" Joy said. "And what are you doing in Dr. Sills' house?"

The men just looked at us. "We're with security, Miss," one of them finally said. "I'm afraid you can't come in."

"Security?" Joy said. "What security?"

"Ihinger-Ibex," the suit said. He showed us an oval badge with the company's stylized ibex on it, in a leather case.

When I thought of security at all, I guess I pictured Walt, at the front gate with his clip-on uniform tie and droopy trousers. These guys looked like FBI agents. I wondered if they carried guns under their jackets.

"This may be a crime scene," the guy said. "You're not allowed in."

Joy, to her credit, was less impressed by his authority than I was. "*Crime scene*?" she said. "You're not a cop. Get out of my way."

Just then Phil came from the living room. "Joyce, I thought that was you. Sam, hi. Come in," he said, gesturing as if it were his house.

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The two security guys stepped out of our way, polite smiles on their faces, and we followed Phil into the living room.

He looked tired; his eyes were pouchy and his clothes were rumpled as if he'd been in them a long time.

"Where's Pinky?" I said."

"He's in the hospital. He's fine—he's fine," Phil said, holding up a hand to forestall the next, obvious question. "It's just a precaution. He was sampling the pharmaceutical wares, Sam." Phil made a face and took a pack of cigarettes out of his shirt pocket and lit up—it was a measure of how shaken he was, I thought, since Phil was very image-conscious and the corporate culture at Ihinger-Ibex was very much anti-smoking. "Do you know anything about it?" he asked tiredly.

I was going to say something about the cabbage, but Joy gave me a subtle nudge. "You look awful, Phil," she said. "Is everything okay at home?"

I thought that odd, given the context, and so did Phil, apparently, since he gave Joy a sidelong look before answering.

"Everything at *home* is fine," he said. "But the office is in absolute chaos; Sills has been freelancing, *and* into the product. He's been unbelievably irresponsible, Joyce—the kind of stuff that could bring the FDA in and shut us down."

Phil was a driven man, and he did worry more than the rest of us about politics, but that was his job. And he wasn't an alarmist. I wondered what Pinky had gotten into that had Phil so visibly shook.

"Did either of you know he was self-testing the product?"

"Are you sure?" Joy said. "Pinky can be difficult, but, really, Phil—as a researcher he's the last one you'd call irresponsible. This is the man who rewrote the Milsam because the old one was too lax."

Joy made a good advocate. *Milsam*, MLSAM: the Manual of Laboratory Safety and Management was the company's technical procedural bible, and Pinky *had* rewritten it, not too many years earlier, because a technician had contaminated an important experiment of his. Ihinger-Ibex had even received a positive citation from OSHA over the new rules. If I hadn't seen Pinky eat that cabbage myself, *I* would have been swayed.

"I don't know what I know, Joyce," Phil said. He sounded disconsolate. "All I can point my finger at is the dozen-odd setups in his lab that weren't in the logbook, and that nobody else knew about. And Sills won't discuss them—he's adamant. What am I supposed to think?"

The rest of the conversation was like that. Joy tried to pump Phil for information while he tried to pump us. No, we couldn't know what hospital Pinky was in; he'd insisted on privacy. No, we didn't know where Pinky might have kept his own files. And so on. When we left, Phil went back to what he was doing—apparently ransacking Pinky's computer for clues to his extra-curricular activities.

I sat behind the wheel of the car, not sure what to do next. "Phil seems pretty shook," I said. "Are you sure it was a good idea not to mention the cabbage?"

"Don't waste too much energy feeling bad for Phil," Joy said with uncharacteristic sharpness. "He's lying through his teeth."

"What?"

"Pinky's not in the hospital; he's at Phil's house," she said. "Phil doesn't care about Pinky's privacy: *Phil*, or someone higher up, doesn't want us talking to Pinky."

This was out of deep left field, both that my wife would think Pinky was being held at his boss's house, and that she'd be so sure of her hunch. Joy was nothing if not an empiricist. I trod carefully.

"Is that why you asked him about home, to get a rise out of him?" I said.

"So to speak." Her expression was opaque.

"What makes you think he's there? Wouldn't it make more sense for him to

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be somewhere on the campus—"

"He's there, Sam. I don't *think* he's there, I know. Do you remember where Phil's house is, or should I drive?"

We'd been to Phil and Nancy's house a dozen times over the years—the usual holiday socializing, mostly. Joy drove over while I thought out loud.

"There's probably going to be more security guys over there, *if* Pinky is at Phil's house," I said. Joy nodded, angry. "Look, if that's the case, you have to avoid glaring at them—in fact, the only way we're going to get to see Pinky is if they believe Phil sent us. We have to give the impression we're on their side—"

"What side is that?" Joy said, cutting me off.

"From their point of view, Pinky is some dangerous loose cannon—I don't know why—so we have to give the impression that we're there on Phil's behalf," I said. "That means treating the security guys as if they're doing you a favor by watching Pinky."

"My husband, James Bond," Joy said, but she smiled.

"I'm glad you're amused," I said.

"I just didn't know you had such a devious streak. Hidden depths," she said. "I think you're right—needless to say."

"Well, he's probably not there," I said. I didn't know where Joy's fey mood had come from, but I was troubled by it, and by what we were about to do if Pinky was indeed being held at Phil's house. It all seemed so unlikely and melodramatic.

The Nguyens' housekeeper answered the door—they lived in a huge old Victorian in Northfield—and we asked for Nancy. We waited in the foyer for a minute and Nancy appeared with a guy in a suit—more security. Up to that point I'd felt foolish, showing up at Phil's house. How were we going to explain that if Pinky wasn't there? Now it looked like Phil was the one who'd have some explaining to do.

"Hi, Nancy. Phil sent us over to talk to Pinky," Joy said in a funereal tone. The impression was that we were dragooned into this unpleasant duty because of our friendship with Pinky.

"They're in the den," she said, looking terribly uncomfortable about the whole thing; understandable, given the corporate goon at her elbow. "Mr. Freeman?" she nodded to the goon.

Mr. Freeman showed no inclination to let us in. "When did you talk to Dr. Nguyen?" he asked.

"We just came from Dr. Sills' house," I said. "Nothing there. Dr. Nguyen should be right behind us—they were just locking up when we left." I used Pinky's professional title deliberately: I wanted the security man to feel as though this was high-level stuff, and not some office wretch making off with a box of pencils.

I must have hit the right note, because he led us upstairs, to Phil's den. I'd never been in that room before. It looked like a set for *Masterpiece Theatre*: deep leather club chairs, an antique desk with brass fittings, and leather-bound books in dark wood bookcases. It struck me as totally unlike Phil, who, whatever his faults, was not a pretentious man. It took a few seconds to register that there was no computer on the huge mahogany desk. It was probably a showcase never used by Phil, but put together by a designer, or by Nancy, about whose tastes I knew far less.

There, being watched by two more guys in suits, was Pinky, looking childlike and pathetic in an oversized wing chair. He was clutching a Byerly's shopping bag in his lap.

"What do *you* want?" Pinky said, looking from me to Joy. To say I was taken aback would be an understatement—it didn't occur to me that Pinky would immediately identify us with his captors.

"You're in a lot of trouble, Erik," Joy said. Pinky's real name sounded strange on her lips. "What the hell is wrong with you?"

"I guess you talked to Phil. Nothing's

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wrong with me," Pinky sounded like a surly teenager. "These Gestapo agents pulled me out of my own lab, in the middle of the day, without any explanation. Phil is convinced I'm freelancing—that's what happens when you become a bean-counter, I guess; you start getting paranoid."

None of this was making sense to me: not Joy's abrasive tone, nor Pinky's defensiveness. The security guys seemed unruffled, however. I briefly thought it might be an act on Pinky's part—Joy was almost certainly acting, though I didn't know to what end—but there was no way Pinky could have caught on before Joy had said a word.

"Pinky, we're just trying to help," I said. "*Something's* going on . . ."

Pinky ignored me, staring morosely at the Byerly's bag in his lap.

"Come on," Joy said to me, "this is a waste of time."

"Wait a minute." We hadn't found out anything yet. I wanted to talk to Pinky alone, without the security men listening. Otherwise, the whole exercise of coming to Phil's house—likely to get us in hot water as soon as Phil found out—was futile.

"Pinky, will you tell me what happened?" I asked, sitting in the chair opposite him. "Would you feel more comfortable talking if these other guys left the room?"

Pinky just retreated further inward.

I turned to the older of the security guys. "You know, he might be a little more reasonable if you gave us a minute or two," I said. My tone was peremptory, but I tried to indicate by facial expression that I was humoring Pinky.

"No can do, Dr. Krase," he said.

"Come on, Sam. There's nothing we can do here," Joy said, rather bleakly, I thought. "Let's go back to campus and get started on the files Phil asked us about."

Well, that was clear enough. Phil hadn't asked us about any files—Joy had her reasons for wanting us out of there, and seeing as how we weren't going to get Pinky alone, and given his uncommunicative state, there was nothing else for me to say. Still, I had to play out the act for the security men.

"Dr. Nguyen has my cellular number," I said to them, getting up. "He can call me if he needs anything." I felt utterly transparent, playing the charade, but the security guys seemed to buy it. It made me wonder how good they really were at their jobs.

"What was that all about?" I said, as soon as we were in the car.

"Let me think for a minute," Joy said. This was a habit—she liked to work things through in her head before she hashed them out with me. I had learned, after a few unproductive arguments, to wait until she was ready to talk.

Joy drove. I was busy fretting, primarily about what was going to happen when Phil heard of our visit; my worries about what was going to happen to Pinky were a distant second. I realized, after a few minutes, that we were heading back to Pinky's neighborhood.

Joy still had her do-not-disturb expression on. I didn't say anything until we pulled into the parking lot of a Byerly's.

"What's going on?"

"A hunch," she said. "I think Pinky left something for us here."

We went in, and Joy steered us straight to the produce section. There, in the display case along with several different kinds of lettuces, were three heads of Pinky's cabbage.

I'd only seen a few individual leaves; never a whole head. They looked like spinach more than anything—deep green, but with reddish veins.

Joy gathered them up and put them in a transparent plastic produce sack.

"That's not going to work," I told her. "The cashiers aren't going to recognize it; they're going to look for a produce code and not find one."

"I thought we'd just bluff through it," Joy said. "They won't refuse to sell

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it to us."

"No, no they won't," I said. But I was uneasy about it. It didn't come to me in so many words, but the feeling I had was that I didn't want any of the cashiers to be able to connect us with those particular greens.

"Let's buy a bunch of other stuff," I said. "We'll throw these in the bag with lettuce—maybe Romaine, they're close."

Joy gave me a peculiar look, but she went along with my idea. We ended up getting lettuce, radishes, onions, and two bell peppers. We'd be eating salad for days. My excessive caution paid off: the cashier hardly glanced at the odd greens, ringing them up as lettuce.

Our drive home seemed prolonged by the edgy silence. There were a number of questions I was itching to ask Joy. How had she known Pinky was being held at Phil's house? How had she known we'd find the cabbages at that Byerly's? What was the act at Phil's all about, and for that matter, how were we going to explain our presence there to Phil when we saw him at the lab?

And the big question: what was Pinky up to—or at least how much did Joy know about it?

In the kitchen, Joy didn't bother putting the other groceries away; she took out the cabbages and tore a few leaves off one.

"Here," she said. "Try these."

I didn't say anything.

"I know my behavior seems strange to you," she said, putting the leaves on a square of paper towel. "This cabbage isn't going to hurt you, though. Eat some and then we'll talk about it."

"How about we talk now, Joy?" I said. I had a sick feeling in my stomach, as if I knew some horrible news was coming. "I already ate as much of these as I'm going to, that day in the cafeteria. What the hell is going on? Have you been eating these cabbages?"

"Yes," she said.

"Are you and Pinky both nuts? Jesus!" I took off my glasses and rubbed my eyes. "Tell me what's going on."

Joy just stared at me, her expression unhappy.

"Why is Pinky in trouble?" I asked when she didn't say anything.

"In the short term, because Phil thinks he's whacked out from sampling the product," she said. "In the long term, because you can't patent a naturally occurring plant."

"You mean the cabbage?" I shook my head. "What's one fungicide, more or less?"

Antifungal drugs were big moneymakers because immune-suppressed people who survived everything else often succumbed to fungal infections. But Phil, and by extension the big shots he answered to, were grownups—they knew that not every avenue led to pay dirt. And Pinky had made them enough money to spend the rest of his career sleeping in his office, if he wanted to.

"You don't understand," Joy said, looking pained.

"No, I guess I don't." I was starting to get irritated. It seemed to me that Joy was holding out on me. That was less scary than thinking she was losing her grip on reality.

"Why don't you stop tap dancing and tell me what the hell's going on, Joy?"

"It's not the cabbage's antifungal properties that have Phil's shorts in a bunch," she said. "It's what Pinky called the cabbage's *mild hallucinogenic properties* that's gotten him into hot water."

"Hot water?"

She sat at the counter and pressed her palms together as if she were praying. It was the same nervous gesture she made when she told me that her mother's estate had left us a quarter of a million dollars richer, *and* when she told me that the house had been burglarized and she thought she'd left the door unlocked.

"First," she said, "it's not a hallucinogen, mild or otherwise. It's sort of a neurotransmitter—well, a neuro*amplifier*."

"Pinky isolated the compound?" I said.

"Yes, but the optimum dose is ob-

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tained by eating the leaves—the neurological effect is achieved by about thirty-nine discrete compounds: the raw leaves deliver a perfectly titrated dose. Very complex molecules."

"And it acts on what sites?"

"All of them," Joy said. "I know"—she held up a hand, palm out—"it sounds bizarre. Its surface is sort of a molecular skeleton key, though."

Something nagged at me. "How long has Pinky been working on this?"

"Since the summer."

"But—"

"I know," she said, "it's years' worth of work, isolating compounds out like that. That's point number two—it's a neuroamplifier that lets you read, for lack of a better word, atomic structures."

The sick feeling in my stomach was getting worse. "What do you mean? How is that possible? It's like . . . reading the data on a magnetic disc with something the size of a skyscraper—no, more! The scales are hugely different."

"The strings that make up subatomic particles—they aren't really strings in any meaningful sense, but never mind that—are arranged in configurations that you could call an alphabet. There are more than twenty-six characters, but that's the basic idea: the particular configuration of the neuroamplifier's own subatomic particles in the cabbage amplifies the signals, for lack of a better word, coming from all the other particles that constitute your body, including those you ingest in food, respiration, and transdermally."

She looked at me anxiously, and it broke my heart a little: whatever else was going on in Joy's head, she was scared.

"In effect," she said, "it's a window into the history of every atom you're exposed to. Everything that's happened to that atom, from its creation in the heart of a star on down through time, leaves a mark on it, and those marks can be read."

My heart sank then. Pinky had gone over the edge, and he'd taken Joy with him. I didn't know where to start the next thing I knew I had to say, so I just blurted it out.

"Joy, you've got to go to the hospital."

"I knew that was going to be your reaction," she said, with what I thought was bitterness. None of this made a lot of sense to me.

"Joy, look," I said, groping for the words to reach her. "What's the most likely conclusion here; that Pinky has discovered a new super-neurotransmitter *and* reformed subatomic physics, or that the cabbage *is* a hallucinogen, and that he, and you, are suffering from its effects?"

"I know." She nodded briskly. "It all sounds delusional. I would say the same thing if I were in your shoes."

Rather than reassuring me, her brightly rational demeanor made me more uneasy.

Joy drummed her fingers on the countertop. "Okay, let me ask you a question: how do you think I knew Pinky was being held at Phil's house? Or that the cabbages were at Byerly's?"

"You said yourself the Byerly's thing was a hunch," I said. "Pinky had a Byerly's bag and we went to the store closest to his house. You knew he had more of the cabbages; how much of an intellectual leap did it take?"

"Okay, then what about Phil's?"

"What about it?" I said, exasperated by her reasonable tone.

"Wouldn't it make more sense if they held him at the campus?" she said.

"Yes. And?"

"Just that it's not the first thing you'd think of—Pinky being at Phil's house."

"No, agreed," I said.

Joy took a deep breath, preparing herself for a dive into deep water. "The air molecules that Phil breathed out, when we were at Pinky's house, had passed through Pinky's lungs *and* Nancy's," she said. "It had to be Phil's home."

I got a phone call one night, two years

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after we'd been married, from a nurse in the emergency room at Hennepin County Medical Center: Joy had been in a car crash. It turned out to be a minor accident, but I died in the five seconds it took for the nurse to put Joy on the line. I had the same feeling of dread now—my wife had gone crazy. Of course she instantly saw the fear in my face.

"All right," she said, her voice sharp, "today you had a root beer with lunch. Lunch was a salad and a salami sandwich on whole wheat bread, with mustard. You got your watch battery replaced. You bought a newspaper and coffee at the little Greek place with the roaches. You were using Ginny's computer sometime today or yesterday and Bill Mason had at least two beers at lunch with you. A shingle on the garage roof is worn through at its bottom edge, and water is leaking into the loft, though it hasn't seeped through the insulation yet. You used my toothpaste this morning . . . Oh, hell, you get the idea."

She looked at me—I must have had a priceless expression—and said in a much softer tone, "I could go on."

I didn't want her to go on. I was confused by how much Joy knew: some of the things she could have guessed by knowing my daily routine and preferences, but not all of them, but I still couldn't buy her explanation. I was used to my wife being a rational person—sometimes *too* rational—and now I had the feeling that she'd swum too far from shore, and I couldn't reach her.

"Joy, you're scaring the hell out of me," I finally said, blurting out the truth because I couldn't think of anything else to say.

"I know." She looked sad.

"I need to think about this," I said. "I'm going to go upstairs for a while."

"All right. I'll fix some dinner, meanwhile. I hope you're in the mood for salad." She managed a wan smile that made me feel worse.

I closed my office door and lay down on the couch. I tried to make sense of what Joy told me—what I knew about subatomic particles and string theory wasn't much—and I tried to find an explanation that was neither drug-induced psychosis nor a new insight into neurochemistry and particle physics. But every time I tried to focus on Joy's seemingly supernatural perception, my mind skipped off the issue like a flat rock skimmed across the surface of a pond. My own anxiety was keeping me trapped above the surface of the problem.

The truth was, I wanted to do anything *but* think about it. I wanted to pull the covers over my head, go to sleep, and wake up back in the rational world. It was the first time, in ten years of marriage, that I felt truly lonely. I fell asleep into a brown morass of emotional fatigue and self-pity.

There was a note taped to my door when I arrived at the lab the next morning: SEE ME. PHIL.

The boom was about to be lowered, I thought. I dropped my briefcase and coat off in my office and went up to see Phil.

"Where's Joyce?" was the first thing he said.

"We took separate cars. She should be here soon."

"Okay. I left a note on her door, and with Phyllis." He sat down on the leather couch and gestured to one of the soft chairs grouped around his coffee table.

"Pinky wasn't freelancing," he said. "And he wasn't sampling the pharmaceuticals."

If Phil's intent was to surprise me, it worked. A dozen possible responses went through my head—jamming each other in the doorway, so to speak. I didn't say anything.

"He hasn't done anything illegal, or unethical, or even against company policy," Phil continued, "and as of this afternoon, he'll be back in his lab, unless he decides to take the rest of the day off."

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I *knew* that Pinky had been eating that damn cabbage—so had Joy. Maybe it wasn't illegal, or unethical—but it *had* to be against company policy. What was I supposed to say to that?

"Why this sudden change of heart?" I said. "Yesterday you had him under house arrest."

"Yes, about that," Phil said. "What was that yesterday, you and Joyce showing up at my house?"

I was at a loss for words again—the last thing I wanted to talk about was Joy's newfound "intuition," doubly so with Phil. I was even more confused that morning because I'd checked the worn shingle in the garage and found it exactly as Joy had said it would be. How did she know? Smell, taste, some other sense? The shingle was invisible from the ground; the drop ceiling, dry to the touch and covered in undisturbed dust, also gave no clue. Until I'd stuck my hand up into the fiberglass wool and felt the wetness, I was sure Joy was wrong.

Phil was staring at me, waiting for an answer. I was never good at hiding my feelings, though, and some of my confusion and doubt must have shown on my face.

Phil leaned forward in his chair. "What's going on, Sam? You look miserable."

"Oh, the whole thing's upsetting," I said. I wanted to tell someone—Joy's mental state, and the considerable question of her involvement in Pinky's problems, weighed heavily on me. I felt cut off from her in a way I hadn't felt since we'd been together. A part of me knew Phil was a very poor choice of confessors, but I think I might have told him anyway, not meaning to reveal everything, of course. I was saved by Joy's dramatic entrance into Phil's office.

"You son of a bitch!" Joy said, staring at Phil. She had a memo in her fist, and when I started to ask what was going on, Joy thrust it angrily into my hands.

It was a notification that Joy was required to appear at a hearing before the company's Professional Standards Committee—the disciplining body for the research workers at Ihinger-Ibex. Pinky's name was also listed as one of the subjects of the hearing. So was I. Until then we were all suspended.

"Well, Phil," I finally said, "this is very nice."

He had trouble meeting my eyes. His hands, seemingly given marching orders by his anxiety, passed over the objects on his desk while he tried not to respond to the anger in my voice.

I left his office, glancing back before I closed the door. He looked like a man who couldn't find his house keys.

In retrospect, I can see that Joy was already cut loose from the moorings of conventional society before we walked out of Phil's office. I planned to fight Phil's maneuvering, of course, but it hadn't occurred to me to do so from outside the system. Joy was already operating out of the blue and into the black, thank you Neils Young and Armstrong.

Had I tried to do it my way, things would have certainly ended up differently. I would probably be in a white-collar prison, somewhere in the Minnesota countryside, making thirty-five cents an hour washing institutional linens.

Sometimes I think that would have been an easier fate to comprehend.

During that time, what I now think of as The Beginning of The End, the subject of the cabbage came up only once. I walked into the kitchen while Joy was shredding some leaves into a bowl, and she started as though I'd surprised her with a lover. After a second's pause, she got a defiant look on her face and continued shredding.

"So you're going to continue with this," I said, trying not to sound angry.

"I am. And I'm going to ask you again if you won't give it a try," she said. "I won't beg, though."

"What if you're wrong, Joyce?" I asked her. "It's a lot to ask."

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She put the leaves down and wiped her hands on a paper towel. "So far we've got two hypotheses working here," she said. "Either you're right, and the Brassica is making me deranged, or I really am seeing deeper into the nature of the universe because of its neuroamplifying properties. That I can tell you things I shouldn't know—about your doings out of my sight and other testable propositions—supports my hypothesis, rather than yours. Okay: can you suggest a third hypothesis?"

Of course I couldn't. I'd thought of little else since our suspension, and I couldn't imagine that Joy's insights, for lack of a better word, were lucky guesses. Moreover, on the one occasion I'd seen Pinky, he'd displayed the same abilities—though he seemed to care less whether I was convinced. He'd been eating the cabbage longer than my wife, and he'd retreated further into his own world.

"I don't have another hypothesis, no," I said, "but I can't believe your explanation is right, either. Just because I can't think of a simpler explanation doesn't mean one doesn't exist."

"Well, that's a dilemma for you, isn't it?" Joy said.

I started to make a furious retort when I realized she was on the verge of crying. Her mouth was set in a firm line, but her eyes were wet with unshed tears. I stood there thinking, *Why is she upset? I'm the one who's left behind.*

Joy, Pinky, and I were all suspended, with pay, for the three weeks until the hearing. It was an unpleasant indication of how seriously the company was taking things.

It was the first time in several years that Joy and I been thrown together all day, every day, and the contact soon began to rub both of us raw. I wanted to *do* something about the situation, but there was nothing to be done. Conversation about the problem was stillborn, the one or two times I attempted it, because there was nothing new to say.

Worst of all, Joy spent an alarming amount of time around the house with the lights dimmed, just staring into space, as if she were watching a private screening of the world's longest movie. It seemed more and more difficult to engage her, and after a certain point I was damned if I was going to chase her down whatever neurological rabbit hole she'd disappeared into.

Ten days into this sentence of enforced passivity, Pinky showed up at our door at eleven at night with a bottle of red table wine and two pizzas that were ice-cold from being driven around in the passenger seat of his car since dinnertime.

I didn't know whether to be relieved or annoyed that Joy came out of her trance at Pinky's arrival. She heated the pizzas while I opened the bottle of Corvo, an inexpensive Sicilian wine that I happened to like. The choice was uncharacteristic of Pinky, who rarely drank, and whose attention to other people's tastes was legendarily deficient.

We ate in the kitchen, and at first the memories of numerous other nights around the table lightened my mood. But Joy and Pinky seemed to be making an effort to include me in the conversation—for the first time in my marriage, and in my friendship with Pinky, I felt condescended to.

After the pizza Pinky got around to the reason he'd come by.

"Joyce said you're still not convinced," he said.

"No," I said. "Though I can't offer a better hypothesis than yours . . ."

"I won't appeal to your empirical instincts," Pinky said, smiling. "Let me remind you of a story, instead. It starts, *In the beginning* . . . Does that ring a bell?"

"What are you talking about, Pinky?" I said.

"The Old Testament, specifically the Judeo-Christian notion of The Fall of Man."

"Yes?"

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"Where do you think that story comes from—eating the fruit of the tree of knowledge?" he said. "I mean, if you accept that the account is not divinely inspired, but is a myth written to explain historical, or pre-historical events. What does that bring to mind?"

"I'm not reassured, Pinky, that you need to bolster your case with Biblical citations," I said. "Whatever the genesis, pardon the pun, of the mythic Fall, I don't buy that it's related to your cabbage."

"No, how about this?" he said. "Here's a plant indigenous to the middle of Africa, including the Great Rift Valley, at least fifteen million years ago, later spreading to the rest of Africa and Asia Minor—fossil evidence is solid on this point."

"Circumstantial at best, Pinky," I said. "You still have to go a long way to show a causal relationship."

"I know, I know," he said. "But the only *proof* is experiential. I know the causal relationship is there, beyond a shadow of a doubt. Don't you think it's the first thing I went looking for? In an experiment without external controls, I had to find some framework to test my hypothesis against.

"Sam, we evolved with this plant, and for millions of years our way of knowing the world was informed by its use. Why do you think written language evolved so late? It wasn't necessary; there didn't have to be written records when everyone could know, directly from nature, everything they needed to know."

He looked off into space for a moment. "I can't even imagine what it must be like to access these perceptions from birth," he said. "I suspect finding this Brassica at our age is like learning a new language in your fifties: once you're past that age of maximum neural plasticity, it takes much greater effort to achieve more modest fluency."

"That's very lyrical," I said, "but then why did written language evolve at all? Why wasn't knowledge of the plant passed down through historical times?"

"Why else?" Pinky said. "Power."

His face was flushed from the wine and the prodigious amounts of red pepper he heaped on his pizza. I wish I could say that he seemed imbalanced; that he had the delusional affect of a zealot, but the truth is that Pinky seemed as normal to me then as he had a hundred other times, arguing some theory over a friendly meal.

"What were the first written records?" he went on. "Accounts. Laws. Who got what from whom; who was allowed to do what to, and with, whom. As long as everyone could know things for themselves—know God, if you want to extend the Judeo-Christian metaphor—as long as there were no intermediaries, everyone was more or less equal.

"But we evolved from killer apes, Sam, and it's in our genes to covet everything we see. Some people more so than others. As long as everyone had access to the plant, there wasn't a way to know *more* than anyone else, but if you took their access away by force, you could make them know *less* than you. And that's the way it's been ever since—imbalances in power enforced by a monopoly on knowledge.

"It also explains, by the way, some of the forkings in the evolutionary bush. Like Neanderthal extinction. Neanderthal brain size, though less than ours, wasn't crucial; brain *chemistry* was. They didn't have receptors for the plant."

Pinky took a sip of his wine. "Not to belabor the point, Sam, but the New Testament, and its notion of redemption, has its roots in the suppressed knowledge of this strain of Brassica. And the same is true for every other belief system you care to name. I know; I checked. They all spring from the same fundamental conflict."

"So you're saying that the status quo is maintained by a global conspiracy to prevent people from eating this plant . . ."

"No, no, no!" Pinky cut me off. "The

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Fall of Man is a good metaphor for what's happened: we don't know what we've lost, other than in a deep, unconscious way. I think the yearning for what we lost drives the universal impulse toward spirituality in humans, but no one is deliberately suppressing the knowledge today; the world just is what it is."

It all sounded highly improbable to me, yet, again, I didn't have the words to rebut Pinky's assertions. Something else occurred to me then. "What about the unlogged setups in your lab? What do they have to do with the cabbage?"

"Nothing," Pinky said. "When I realized I'd been indiscreet about the Brassica, I threw together some apparatus to make it look as though I was distilling a compound from the leaves. Completely worthless."

I looked from him to Joy. "So Phil doesn't know you're eating the leaves? What does he think—what did you say to Phil that made him shut down your lab and drag you off the campus?"

"You have to understand, I was very distracted," he said. For just a moment, this was the old Pinky, confessing to some gaffe he'd made in front of the brass. "I told him he had lung cancer, small cell carcinoma, which he already knew . . ."

"What?" I said.

"Yes," Joy said, "Mildred knew, too, because she had to make his chemo appointments, but otherwise Phil played it very close to the vest."

"I feel bad—I got Mildred in trouble because he thought she told me about the cancer," Pinky said. "Anyway, that wasn't what kicked over the termite heap."

"What did it?" I asked.

"I told him I cured him," Pinky said. "I blurted it out without thinking. Naturally Phil thought I was stoned on something I'd either gotten my hands on or cooked up in the lab. And of course he'd already heard about the cabbage. . . . He's going to be very surprised at his next checkup."

I don't know if I believed Pinky in the moment, but certainly my ability to feel surprise had been cauterized. I looked over at Joyce: obviously none of this was news to her. I thought I sounded calm when I asked him how he'd cured Phil's lung cancer.

"Trivially easy," Pinky said, dismissing it with a tired wave. "It's—"

He stopped, apparently lost for words. He looked at me and his expression was sad. I was getting tired of that look.

"You know," he finally said, "when a student who doesn't have any mathematics asks a question that can only be answered mathematically? I can tell you how I did it metaphorically, but unless you know the way *I* know, it's just going to sound off the wall."

I was too numb and exhausted for even my pride to be stung. Either my wife and best friend were on the fast track to the paper slipper academy, or the world as I understood it had ceased to exist.

"I'll have to think about it," I finally said. It sounded lame, even to me.

"I know," Pinky sighed. "I'll say just one more thing. I don't want you to feel as if I'm pushing you into anything, but you can change your mind anytime. I have plenty more of the Brassica."

"I thought they took everything from your lab?" I said.

"Yeah, but I'm growing them in a few other places, and I have tons of seed—that's how we had them shipped to the company, as seed—it looks almost like beach sand. Ten grams is enough to plant two or three acres. Anyway, just ask, all right?"

I said that I would, and Pinky took that as enough of an answer. The three of us polished off the rest of the wine, and talked about getting lawyers and what would probably happen at the hearing.

When Pinky left, his convertible top still down, it was four in the morning and cold. The air was very still and clear, and outside the range of our porch light,

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the Milky Way was a white band across the sky. I stood outside as long as I could in my shirtsleeves, trying not to feel the Earth shifting under my feet.

That Ihinger-Ibex had a corporate security infrastructure larger than a few uniformed guards on the edge of retirement was obvious, and unsurprising in retrospect: it was a huge company with profits in the hundreds of millions that depended heavily upon proprietary information. Until the knock came the morning after Pinky's visit, it never would have occurred to me that we were under surveillance.

The corporate attorney and security men were accompanied by a city marshal who was apologetic but businesslike: *pursuant to a civil warrant, designees of Ihinger-Ibex were empowered to search the premises, blah, blah, blah . . .*

"No one expects to find any corporate property here, at least none that isn't appropriate to your work for the company," the attorney said, once we'd heard the judge's order. "But it's one of the steps we have to take, legally speaking, to make sure you and Dr. Sills are afforded due process at the professional standards hearing."

"So you're doing this for our benefit," Joy said.

"Of course not," the lawyer said, not missing a beat. "We all know I'm here to protect the company's proprietary interests. But frankly, I don't think we're going to find as much as a box of company paper clips; and that will only reflect to your advantage at the hearing."

"Well, *that's* a bit self-serving," Joy said, "whether it happens to be true or not."

The lawyer flipped through a sheaf of papers from his briefcase. "I'm not the cause of your problem," he said distractedly. "But if you want to be mad at me because your colleague is irresponsible, and because *you've* given your division head reason to worry, then go ahead."

And the truth was, the whole process was as impersonal as hell. We were wearing the wrong uniform, and that was all the storm troopers cared about. We were now the other side.

They left, after turning our house, garage, and grounds completely inside-out. They left empty-handed, which didn't seem to surprise them, but surprised *me* a great deal. Some of the incriminating cabbages had been in our refrigerator that morning.

"Now what?" I said to Joy, once they were gone.

She gave me the kind of fey look I'd been seeing more and more lately. "Why are you asking *me*?" she said.

Her question, and more her tone, pierced a weak place in me, which is why I responded the way I did.

"Why? Because you and the genius started all this," I said, gesturing around at the house turned upside-down by the search. "Because we are, very probably, going to lose our jobs, our careers, the house. . . . Because Pinky finally let his adolescent rebelliousness get the better of him, and *you* went along with him!"

I was shaking with anger and fear that I didn't realize I'd been holding in. I was enraged at the way my house had been casually and impersonally violated, and terrified about what was coming next.

"Another thing," I said, warming to my anger, "what did you do with the cabbages? How did you know to hide them? *Where* did you hide them?"

"I didn't hide them," she said. "I ate them. This morning."

"All of them? Are you kidding?"

"Of course all of them," she said. "They didn't find any, did they?" Joy tossed the cushions back on the living room sofa, then sat down. "Don't worry about the hearing."

"What?"

"If you're worried about the hearing, don't be," she said. "You'll be fine unless you incriminate yourself. You didn't eat any of the leaves; you were against the whole thing. You can say that truthfully."

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"Why do I get the impression you're angry about that?" I said. "You're asking me to take a lot on trust—"

"It's not that you didn't trust me," she said, cutting me off. "Not mostly. It's that you want to be right more than you want to be with me."

That stopped me cold. Wherever my wife, and Pinky, had gone, I didn't want to follow. It didn't matter whether the end of the trail was a locked ward or a world I couldn't imagine, nothing was going to make me step across that threshold. Not even Joy.

She looked at me, and she knew: her expression miserable and guileless as a little girl's. It was the worst moment of my life.

I put my arms around her while she cried. I thought about how bitter it was that the only connection we seemed to have then was pain. In that moment of heartsickness and grief maybe I grew a very little, and I knew what I had to do.

We hired lawyers for the hearing because the company expected it. In the week beforehand, we packed up what Joy would need in her new life—very little in the way of material things, as it turned out. Lots of Brassica seed, though. As far as I know, Joy didn't speak directly to Pinky all week, but at 8 o'clock on the Friday before the hearing, he showed up at the door: two days would be more than enough lead time for them to make their getaway. They didn't take a car, and whoever was watching the house, if they still were, didn't see Joy and Pinky climb over our back fence and disappear into the night.

I couldn't have been the only one who wasn't surprised that they didn't show up for the hearing. I know I was the only one who was surprised by my arrest.

My lawyer had me out in a few hours: according to her, the trumped-up corporate theft charges would go away as soon as Ihinger-Ibex was convinced I couldn't lead them to Joy and Pinky.

I took polygraphs. The detective tried, in an embarrassingly familiar man-to-man way, to insinuate that Joy and Pinky were lovers, and that I owed neither of them any loyalty. I was threatened with prison: "Forget what you heard about country club prisons, Doc. All prison time is hard time."

After a month, the charges were dropped. The company hearing, rescheduled, rescheduled again, and rescheduled a third time, was finally cancelled altogether. Everyone, it seemed, was more concerned with returning to the status quo ante bellum than in looking too closely at what had happened.

Phil left the company about the same time his lung cancer went into "spontaneous remission." If any further work was done on Pinky's cabbages, no word of it reached me. After four months in a kind of caretaker position in my own lab, I applied for and received early retirement.

If retirement is slow, it has its compensations. I have time to think and read and follow my own informal lines of research. The newspapers deliver interesting items almost every day: a sixteen-year-old in Albuquerque who published a brilliantly original paper on neutron decay in her high school newspaper; a San-Francisco waiter who's become a millionaire investing tip money in the stock market; two college athletes from Boston who, within a week of each other, set new international records in the hundred and six-hundred meter times; a Florida woman whose homemade herbal tea appears to reverse the effects of Alzheimer's Disease.

For every article that appears, I'm sure there are dozens, maybe hundreds of other micro-revolutions in human events taking place, springing up in the wake of a non-descript, middle-aged couple's travels.

I'm relatively young, and in good health. It is possible I'll live long enough to be the last Neanderthal. ■

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People can adapt to a very wide range of circumstances, but one thing remains constant: they must usually act on incomplete knowledge.

Sun of Suns
Part II

Karl Schroeder

Illustration by George Krauter

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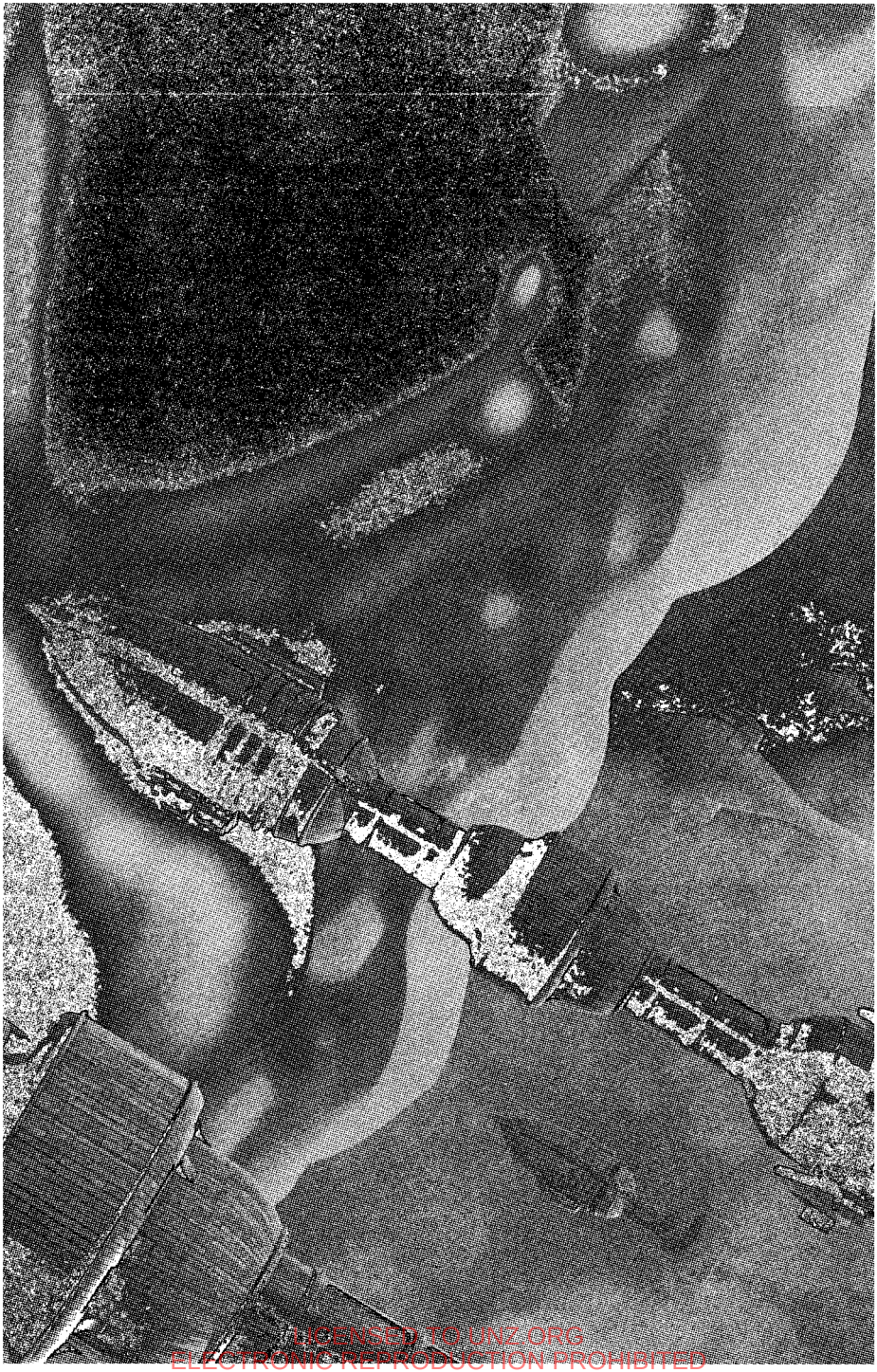

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The story so far . . .

Imagine sky with no earth: clouds dot the blue, receding to infinity in all directions. To one side a distant sun casts its light across hundreds of miles, sending shafts of shadow radiating from the clouds that surround it. Opposite it, the blue fades to black. There is no gravity here—rocks twirl and balls of water undulate in the chill air. Spinning in the middle distance is a wooden wheel two hundred feet in diameter, its inside surface paved with buildings. And inside one of these buildings, young ***Hayden Griffin*** *is sulking.*

Hayden is oblivious to the strange beauty that surrounds him. He's lived his whole life here in Virga and is unsurprised at a world where you have to make your own light, heat, and gravity. Virga is a fullerene balloon five thousand miles in diameter, filled with air, tumbling rocks, and water—about a Pluto's worth of volatiles. This artificial habitat orbits alone in the outskirts of the Vega star system; but Hayden knows nothing of that. He's spent his entire young life focused on the political struggles of his own nation, Aerie, in its fight against invading forces from the migratory country of Slipstream.

Hayden's mother is part of a secret project being undertaken here on the edge of darkness. She is part of a resistance group fighting for Aerie's independence. Since Slipstream destroyed Aerie's nuclear fusion sun ten years ago, Aerie has been utterly dependent on Slipstream for light and heat. An engineer, Hayden's mother has come here to the cold edge of Winter to build a new sun for Aerie.

An ominous note enters the ordinary day: it is the sound of approaching jet engines. Hayden runs outside in time to see a fleet of Slipstream warships approaching. The secret project has been discovered. Soon the air is full of snarling jets [illegible] rider. Dogfights surround the town and the glittering, half-built sun floating a mile away. Determined to help his mother and the resistance, Hayden impulsively mounts one of the town's jets (which are called bikes) and dives into the conflict. He is too young to control the massive bike, however, and it crashes into an approaching warship.

As Hayden spins helplessly into the unlit airs of Winter, he sees the new Aerie sun explode, with his mother inside.

Time: eight years later. Place: the city of Rush, capital of Slipstream. ***Venera Fanning****, wife of the admiral of Slipstream, enters the ladies' lounge of the admiralty, leaving her manservant outside. This is one of the meeting places for the spy network she runs. The men she meets show her some photographs that indicate a military buildup in the neighboring nation of Falcon Formation. Disturbed, Venera goes to warn her husband.*

Her manservant is none other than Hayden Griffin. He has infiltrated the Fanning household with the intention of killing ***Admiral Fanning****, whom he blames for his mother's death. Despite his determination, he keeps finding reasons to put off doing the deed.*

That night, there is a sneak attack on Rush while Hayden is wandering the streets of the city. Another of Slipstream's neighbors, Mavery, is blamed—but Venera and her husband Chaison know that Mavery is conspiring with Falcon Formation. The trouble is, they can't convince the government, which has decided to send the Slipstream fleet into Mavery. With the fleet distracted, Falcon will mount an attack on Slipstream. If they are to save Slipstream, they will have to do something themselves—something audacious.

While husband and wife debate, Hayden sneaks up to their office, knife in hand. But at the crucial moment, he is [illegible]

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to get his things together. They are leaving tonight. Paralyzed by indecision and doubt, he dumbly nods before retreating in shame and frustration.

So it is that the next day, Hayden finds himself boarding a Slipstream cruiser behind Venera Fanning. As they leave Rush to great fanfare, he meets some of the other members of the expeditionary force. One is the ship's go-fer, the weasel-faced boy ***Martor****. Another, the new armorer, is a beautiful young woman named* ***Aubri Mahallan****.*

Seven ships, led by Admiral Fanning's, break off from the main group. Despairing and mystified, Hayden watches as the sunlit realms recede. He, the Fannings, and his new crewmates are headed at full speed away from Slipstream, away from Mavery, and away from Falcon Formation—and into the fathomless darkness and cold of Winter.

6

The *Rook's* hangar was a deep pie-shaped chamber taking up one-third of the length of the ship. Most of the space was bikes, all lashed to the walls like somnolent bees in a hive; but two big cutters made the stern area into a well of shadows, each boat a forty-footer armed to the teeth. Hayden eyed these as he slammed an access panel on the bike Venera Fanning had brought for him. The cutters were weapons, of course, and so distasteful to him; but they were also ships, and he couldn't help wondering how fast they were and how maneuverable they'd be to steer.

The bike was ready. He gave it one last appraising look. This wasn't his bike, but it was a racer, complete with two detachable sidecars and a long spool of grounding thread for those situations where you outran your own rate of static charge drain.

Hayden had been staying up late so as to be awake during nightwatch—there were fewer people around—so he was startled when Martor's thin face popped over the bike's small horizon like some parody of the sun. "Watcha doin'?" said the gopher in his usual challenging way.

"Shouldn't you be asleep?" He unclipped the bike from its drydock clamps and hefted it, judging its mass. There were traces here and there of red paint, but sometime very recently it had been redone a glossy black. He didn't mind that.

"Could say the same about you." Martor hand-walked around the clamps to look at what Hayden was doing. As he did the wind keened particularly loudly past the ship's outer hatches. Martor jerked his head in that direction.

"Still worried about Winter? It's a bit late for that," Hayden pointed out. "We've been in it for days."

"You're not taking that out in it?" Martor watched in distress as Hayden dragged the racer in the direction of the forward bike hatch. "Ain't it'll freeze you like a block of ice?"

"It's not that cold." The bike started to drift as they passed the center of the chamber so Martor steadied it with his own mass. "Clouds insulate the air," said Hayden. "So it only gets so cold. Usually doesn't even get down to freezing, most places. Hey, why don't you come along for the ride? I'm just taking her out for a practice run."

Martor snatched his hands back from the bike. "You crazy? I'm not going out there."

"Why not? I am."

A couple of members of the hatch gang had heard this and laughed. They were lounging next to the big wooden doors, awaiting any order to open them. Hayden nodded and they reluctantly abandoned their cards to man the winch wheel.

"Hang on there!" Both Hayden and Martor turned. The eccentric armorer, Mahallan, was poised at an inside doorway. Her silhouette was very interesting, but she only perched there a moment before flying over to the hatch. "You boys going for a night flight?"

Hayden shrugged. "All flights are night

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flights right now."

"Hmm. Glad to see you've overcome your fear of Winter," she said to Martor. The boy blushed and stammered something.

"Listen," continued Mahallan, "I'd like you to do something for me. While you're out there—I know it'll be dark, so you probably won't see them—if you spot anything like this, could you bring it back?" She opened her fist to reveal a bent little glittering thing, like a chrome wasp.

Martor leaned close. "What's that?" Hayden plucked it from the air and turned it so its wings rainbowed in the gaslight. "I've seen these before," he mused. "But I don't know what they are. They're not alive."

"Not by ordinary standards, no," said Mahallan. She was perched on his bike, an angel in silhouette; rearing back she said with some obscure sense of satisfaction, "They're *tankers*."

Martor smiled weakly. "Ha?"

"Tankers. That little abdomen is an empty container. Usually when you catch one and open it, you'll find the tank full of ugly chemicals like lithium pentafluorophenyl borate etherate, methoxyphenylboronic acid or naphthylboronic acid. Very interesting. And where do you suppose they're taking it?"

"Couldn't tell ya," said Martor, whose eyes had gone very wide as the multi-syllabic chemical names tripped off Mahallan's lips.

"They're going *in*," said the armorer. "Towards Candesce." She snatched the metal wasp out of the air. "Find me some more. If you can."

"Yes, ma'am." Martor saluted and turned to Hayden. "Lets' get goin', then."

The hatch gang spun their wheel and the bike door opened into total darkness. As Mahallan kicked away to presumably return to her little workshop, Hayden leaned in to Martor and whispered, "You forgot the passenger saddle. It's over there." He pointed.

"Ah. Uh, thanks."

Mahallan left, and Hayden waited for Martor to back out of his impulse to come along. But he returned with the saddle and dutifully waited while Hayden strapped it to the side of the bike. And he climbed aboard meekly and waited while Hayden guided the fanjet to the open hatch and shoved it out into the light breeze, following himself a second later.

"It's not cold at all!" Martor squinted over his shoulder as Hayden opened the throttle a bit. They shot away from the *Rook*. The bike was admirably quiet, so Hayden was able to lean back and say, "It's the clouds. They trap the heat."

Now that they were in Winter, the ships of the expeditionary force had all their lights on. Distant clouds made a tunnel that curled away ahead of them, but the air was clear for miles around. It was an opportunity to open up the ships' throttles that their pilots were stolidly ignoring. True, they were making twenty or thirty miles per hour, but each could do five times that without straining.

"Shall we open it up and see what she'll do?" Hayden asked. He didn't wait for Martor's answer, but gripped the throttle and twisted it. The fanjet's grumble became a roar and they shot ahead and into the full blaze of the *Rook's* headlamp.

Martor pounded him on the back. "Quit showin' off!"

Hayden laughed. "No! Look back!"

Martor turned awkwardly and gasped. Hayden knew that their corkscrew contrail would be gleaming in the cone of the *Rook's* headlight like a thread of fire.

"Come on, Martor. Let's do some stitching!"

The bike was capable of nearly two hundred miles an hour, and he tested it to this limit over the next few minutes, running lines back and forth parallel to the *Rook's* course. Laying down parallel lines like this was called stitching. Following his own contrail was the safest way to test the bike's speed; if he entered cloud or deviated too far from air he knew was

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clear, he could kill himself and Martor if he ran into something unseen.

Hunkered down behind the windscreen, he could nonetheless feel the rip of the air inches away, and cautioned Martor not to stick his head—or hands or feet—out lest he get them ripped off. The bike performed well and he quickly got a feel for it.

"Right!" he said eventually. "Let's do a bit of exploring." He eased back on the throttle and nosed them in the direction of the encircling clouds. As they were about to enter a huge puff-ball, he turned the bike and hit the throttle again; the ground wire trailing behind them whipped ahead into the cloud, and sparks flew.

"Is this a good idea?" Martor had been whooping with delight a minute before. He seemed afraid of anything new, Hayden mused.

"It's a great idea." Now that they'd shed their static potential, it was safe to push the bike into the cloud, a transition noticeable only in the drop in temperature and sudden appearance of the cone of radiance from the bike's headlight. Hayden glanced back; the *Rook* was invisible already.

Martor shook Hayden's shoulder. "H-how are we going to find the ship again?"

"Like this." He reached down and shut off the engine. As the whine faded, he heard a distant grumble—the other ships—but it seemed to be coming from all around them at once. "Wait for it."

The fog-horn's note sounded low and sonorous through the darkness. "Where did that come from?" he asked Martor.

"That way?" The boy pointed.

"Right. Now, we're not going far. I just want to see if there's another side to these clouds." He spun up the bike again.

The mist seemed to go on forever, an empty silver void. After a few minutes, though, Hayden began to see pearl-like beads gleaming in the headlight. They shot by on either side, and at their lower speed Martor was able to reach out and grab one. It splashed into a million drops in his hand.

The water spheres grew more numerous, and larger. "Could they stall the engine?" asked Martor nervously.

"A big one could," he replied. "Like that one." He dodged the bike around a quivering ball the size of his head.

Visibility was improving. They were now idling their way through a galaxy of turning, shivering drops, some of them tiny, some big as men. Reflections and refractions from the bike's headlamp lit the water cloud in millions of iridescent arcs and glints.

Martor was silent. Hayden looked back at him; the boy's jaw was slack as he gaped at the sight.

"Look." Hayden cut the engine and with the last of their momentum steered them over to a water-beaded stone that hung in solitary majesty amid the water. The rock was less than two feet in diameter.

"Well?" he said to Martor. "Aren't you going to claim this piece of land for Slipstream?"

The boy laughed and reached up to grab the stone. "Not like that!" Keeping one hand on the bike, Hayden flipped himself out of the saddle and wrapped his legs around the rock. "You've got to sit on a piece of land to claim it, you know.

"I decree this land the property," he said, "of . . ." *Aerie.*

"Of Hayden Griffin!" shouted Martor.

"Okay. Of the sovereign state of Hayden. Uck, it's wet." He kicked it away and settled into a perch on the windscreen of the bike.

"I didn't know it was like this out here," said Martor. "I grew up in Rush."

"Rush isn't the whole world, you know." Hayden sighed and looked off into the dark. "But it's not all like this either. There's . . . things out here."

Martor looked alarmed. "I thought you said there wasn't!"

"Well, I've never seen anything. But you hear stories. Like the ones about the black suns. Ever heard of them?"

Martor's eyes had gone round.

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"Pirate suns. They're small and weak—they only heat a few miles around them—but it's enough for several towns to thrive. And they only shine through a few port-holes, to spotlight the towns and nothing else. Black suns, they call them, each one surrounded by the ships the pirates have captured, in a cloud of wreckage that hides the glow of the towns . . . They're migratory, like Rush, and they could be anywhere . . ."

"You're making that up."

"Strangely enough, I'm not." The chill was starting to eat at him, so Hayden swung back into the saddle and peddled the engine into life again. "We should get back."

They flew in the direction of the most recent fog-horn, not talking for a while. As the water cloud tapered out, replaced by mist again, Martor said, "Do you think we'll be coming home? After whatever it is we're out here to do, I mean."

Hayden frowned. "I don't know. I . . . wasn't counting on it, personally." *What's there to come back to?* But he didn't say that.

"Do you suppose there's something in Winter that's threatening Slipstream?"

"Seems unlikely."

"And what about the armorer?"

"Huh? What about her?"

"I overheard some of the officers talking. They said she's . . . not from here. Not from the world."

"What do you mean, not from the world?"

"Not from Virga. That doesn't make any sense, does it?"

Hayden thought about it. She did have a funny accent, but that didn't mean anything. He dimly remembered his parents talking about a wider universe beyond Virga; he tried to recall what his father had told him. "There's other places, Martor. Places that are all rock or all water, just like Virga's all air. It could be that she's from somewhere like that. After all, they say we all were, originally."

"Oh, now you're—" Martor swallowed whatever he was going to say, as a giant shape loomed up ahead of them. It was one of the ships, though not the *Rook*.

"Home again," said Hayden. "Let's find our own scow."

"Hey! Don't call the *Rook* a scow!" They accelerated past the ship and into its light. Hayden intended to make a spiral and locate the other ships by their lights, so he took them ahead of this ship's outrider bikes, into the night.

So it was that he had several seconds in which to be surprised as he saw a gleam of light shooting straight for him, a gleam that quickly resolved into the light of a bike—a light that quavered and shook—and time to shout a curse and turn the racer, nearly toppling Martor off his saddle. Time to hit the collision warning on his horn and narrowly miss plunging them into the solid wall of black water that blocked the sky in all directions.

Time enough to turn and watch as the ship they'd passed sounded its own alarm and began to deploy its emergency braking sails. Too late: it flew in stately majesty into the wall of water and disappeared in a cloud of foam and spray.

Spotlights pinioned the crashed ship—although it wasn't so much crashed in the small sea, as embedded. The surface of the sea curved into the mist in four directions, and clouds formed another wall directly behind the six free vessels whose headlamps were aimed at it. The cones reflected off its intact sides and into the water, making a diffuse blue aura there that was attracting fish.

The *Tormenter* was stuck three-quarters into the water, its forlorn tail orbited by a halo of water balls. As Hayden and Martor watched from the hangar hatchway of the *Rook*, gangs of engineers and carpenters were slinging lines to the other ships to pull her out. A breeze, chilly and damp through and through, teased and prodded at the warmer air inside the ship, and intermittently ruffled the surface of the sea.

"Who sounded the alarm?" somebody asked behind Hayden. Without thinking,

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he said, "I did."

"You're not one of their outriders." He turned and found himself facing Admiral Fanning, who floated in the hangar in a cloud of lesser officers.

"W-what?" Hayden felt like he'd been kicked in the stomach. He'd hated this man at a distance for so many years that the very idea of talking to him seemed impossible.

"He was doing a practice flight on my instructions." Venera's bloodless servant, Carrier, hung in the shadows to one side.

"Ah." Fanning rubbed his chin. "I can't decide whether the warning helped or did more damage. If they hadn't tried to extend the braking masts, they wouldn't have snapped off when they hit the water. However, doubtless your heart was in the right place." He peered at Hayden, seeming to notice him for the first time. "You're one of the civilians."

"Yes, Admiral, sir." Hayden's face felt hot. He wanted to squirm away and hide somewhere.

The admiral looked disappointed. "Oh. Well, good work."

"Lights!" someone shouted from the absurd jut off the *Tormentor's* tail. "Lights!"

"What's he going on about?" Fanning leaned out, right next to Hayden, his face a picture of epicurean curiosity.

"Shut down—all—lights!" It was one of the foremen, who while yelling this was pointing dramatically at the water.

They looked at one another. Then Fanning said, "Well, do as the man says." It took several minutes, but soon the spotlights and headlights were going out, one after another, leaning shadows back and forth through the indigo water.

"There!" The faint silhouette of the foreman was pointing again. Hayden craned his neck with the others. The man was indicating a patch of water near the *Tormentor*—a patch where suddenly, impossibly, a gleam of light wavered.

When Hayden had seen the size of this sea, he'd wondered. Now he was sure.

"It's just a glowfish!" somebody yelled derisively. But it wasn't. Somewhere in the depths of the miles-wide ball of water that the *Tormentor* had hit, lanterns glowed.

"Do a circuit!" shouted Fanning to a waiting formation of bikes. Their commander saluted and they took off, contrails spreading to encircle the spherical sea like thin grasping fingers. Almost immediately one of the bikes doubled back. It shut down and did a high-speed drift past the *Rook*. "There's an entrance!" shouted its rider. "Half a mile around that way."

Hayden nodded to himself. You could dig a shaft into a water ball as easily as a dirt or stone pile. Farmers regularly used such shafts as cold-storage rooms. From the faintness of the shimmer here, though, the ones who'd dug this tunnel had taken it deep into the sea. And the extent of the lights suggested more than just a few rooms carved out of the cold water.

"*Warea*," he muttered. He turned to Martor. "This might be Warea."

"Huh?" Martor goggled at him. "What you talking about?"

"Warea. It's one of the towns I . . . heard about back when . . . when I lived with some folks who traded into Winter. I heard that Warea was dug into a small sea, as a defense against pirates."

"You know this place?" Fanning had noticed him again. Hayden silently cursed himself for speaking up.

"It's a small independent station," he told the admiral. "Paranoid about pirates and military raids—they won't take kindly to seeing your ships out here, sir."

"Hmm. But they could have some of the supplies we need to fix the *Tormentor's* masts, eh?" Fanning squinted at the distant glow. "They've probably got divers in the water now, watching us dig her out. Can't hide that we're military . . ." He thought for a second, then nodded. "You, the boy, Carrier, and two carpenters. Go in, negotiate a purchase. Foreman'll give you a manifest. Tell them we've no interest in them beyond buying what we need."

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"But why us?"

"You because you know the place. The boy because he looks harmless. Carrier because he also looks harmless, and because you and he are obviously civilians." He looked down his nose at Hayden's shabby shirt and trousers.

"Sir!" It was the armorer, Mahallan, coming up from below. "This settlement—they might have some of the things I need."

"Go on with you, then." Venera Fanning had also appeared. As she sailed in from the left, the admiral glared at her and said, "Not a chance."

"He's my pilot." She indicated Hayden. "He takes orders from me."

"I'm the only one who gives orders on this ship." Fanning turned away from her. Venera's eyes narrowed, but she didn't protest any further.

"There's no sign," muttered Slew, the head carpenter. Hayden shot him an incredulous look. There certainly was no garish, brightly-colored sign over the entrance to Warea; "You mean one that says 'Loot Me?'" he asked.

"How does it work?" Mahallan climbed down from one sidecar of the bike as Hayden reached out to clip a line to the nearest strut of the entrance framework. They floated just outside the dark shaft that led into Warea; nobody had come out to greet them. Mahallan's question was unnecessary, though, Hayden thought. The scaffolding of the entrance shaft stuck ten feet out of the water, far enough to make it plain how it was constructed.

"Look, it's simple," he said, slapping the translucent wall of the shaft; it made a faint drumming sound. The builders of Warea had taken a simple wooden skeleton, the sort the Rush docking tubes were made of, and wrapped it in wax paper. Then they'd stuck the assembly into the side of the sea, like a needle into the skin of a giant. Up this close, he could see faint striations of tangleweed matted under the surface of the water. Warea probably cultivated the stuff—which was an animal, not a plant—to provide structural integrity to the vast ball of water in which they lived. Without it, a stiff breeze could tear the sea apart.

The shaft made an impenetrably dark hole in the water, unlit, possibly leading nowhere—except that a tickle of air teased Hayden's brow, and his bike was slowly being sucked inwards.

"We're wasting time." Carrier kicked forward, his foot-fins driving him quickly into the dark. Hayden flipped off the bike and gestured for Martor to follow. Mahallan was already inside the tunnel, flanked by the carpenters.

Inside there was little to tell they were entering a world of water. The tunnel was a lattice of beams, like those of any freefall scaffold. The surface stretched between them could have been stone in the dimness of lamplight. Only the clammy chill suggested the nearby presence of the sea.

"I would have thought the walls would bulge inward or something," said Mahallan. "But of course they don't. No gravity, no pressure."

"I've heard that word before," said Martor in an overly-casual way. "*Gravity*. Spin makes it, right?"

Mahallan had been doing a hand-over-hand walk along the struts. Now she stopped to look at Martor, and in the dim light he saw her eyes had gone wide. "Sometimes I forget," she murmured, "that the strangest of things here are the ones I talk to."

"Now what's that supposed to mean?" But she had turned away already. Ahead, Carrier shouted for them to be quiet.

He was silhouetted by flickering lamplight from a number of fan-driven lanterns. Beyond him the tunnel opened up into a broad space—a cubic chamber walled in wax paper and about forty feet on a side. This was a hangar, Hayden realized, for it was filled with bikes and other flying devices. The air here was cold and damp, but the six men who were pointing their rifles at the newcomers didn't seem to feel it. They were uniformly

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dressed in dark leathers, and their narrow pale faces had the sameness of kin. It seemed like a small welcoming committee, but Hayden was sure that the faint motion of the paper walls next to him indicated more men hiding in the water outside.

"State your business," said their leader, who was clearly the oldest. The father of the others, perhaps?

"Trade," said Carrier. "Carpentry supplies. We can pay you whatever you think is appropriate."

"We're not trading," said the older man. "Be on your way."

There was a momentary silence; Carrier hung perfectly still. "What now?" Mahallan whispered to Hayden. "Does he threaten them?"

Hayden shook his head. "It's hardly worth our while to fight a pitched battle for some nails and wood, and they know it. I don't know what he'll—" He stopped, because Carrier was speaking again.

"As you can plainly see," he said, "our charting expedition is well-enough supplied that we don't *need* your help. But it'll shorten our stay if you do help us."

"Charting?" The older man looked alarm. "Charting what?"

"Oh, just the various objects in this part of Winter," said Carrier with a negligent wave of his hand. "Forests, rocks, lakes—anything that might drift into our space someday. Or that might be useful or militarily significant."

"We're of no use to nobody," said the leader. He was visibly tense now. "We want to be left alone."

"Well, then," purred Carrier, "I'm sure our captain could be persuaded to leave one or two objects off of the charts. If, that is, we received something in return."

"Wait here." The man turned and left through a prosaic-looking door that opened out of the hangar's far wall. A few minutes later he returned, looking unhappy. "Come ahead," he said. "You can trade."

So it was that they entered Warea and learned how the cast-out and the fugitive lived in the empty spaces between the nations. The walls of the short corridor between the hangar and the town complex glowed from distant lamplight; long shadows cast on the paper walls suggested some sort of layered barrier between the cold of the sea and the town. In fact as they passed through the next door, the temperature rose and the dampness receded. The silhouetted bodies of the people in front of Hayden split off one by one, opening more and more of the space to his view until he was there himself, gaping about at the cave that was Warea.

Mostly it was just a cube like the hangar, but several hundred feet across. Floating in this space in a disorganized jumble were various multi-sided houses, each one tethered to its neighbors or the space's outer struts. Numerous openings led off from the main cube, some terminating almost immediately in walls of gelid water, others twisting away, their lamp lit outlines faintly visible through the paper walls of the cave. The place reeked of burning kerosene and rot, but it was reasonably warm, and the big industrial lanterns with their grumbling fans at least prevented an aura of total gloom from overtaking the citizens.

Some of these were staring in open hostility as Carrier led his group into their crowded airspace. The town elders who had decreed that they could enter had discretely retreated, or chose to remain anonymous within the mass of people. Carrier stopped to ask directions and while he did, Hayden examined the people. They had a familiar look: sallow, overstretched, and glum. For the most part they were exiles who remembered growing up within the light of a sun. Unhappy they might be, but few of them showed the signs of weight-deprivation.

In a few minutes he saw why. The far wall of the cube was moving—swinging up and to the left with a constant rumble that quivered the walls. The cube was only part of Warea. An entire town was

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embedded in the sea, and on part of its rotation the wheel passed through the cube like a giant saw cutting into a block of wood. Hayden watched houses, shops and markets pop out of the cube's wall and swing up to vanish through the ceiling in steady and relentless motion.

"It's not a small place," muttered Carrier. "There's two markets. Dry goods on the wheel, armorer. Building materials here."

"We'll split up, then," said Mahallan helpfully.

"Watch yourselves," said Carrier with a disapproving frown. "Meet back here in an hour."

Hayden, Martor, and the armorer watched the others vanish into a cloud of people in the building market. The place was crowded with huge baskets filled with white bricks and beams. "Looks like they'll find what they need right off," said Mahallan worriedly. "Let's hurry—we wouldn't want to keep them waiting."

Hayden shrugged and turned to coast in the direction of the wheel's axis. "I didn't see any wood back there," he commented.

"But what was all that white stuff?"

"Same as these houses are built with?" He did a course correction by slapping one on the way by. Its white brick surface undulated slightly. "Paper. They fold origami bricks and beams in triangular sections and then fill them with water. You get beams and bricks that are stiff and incompressible."

"Really?" She seemed inclined to stop and admire the buildings. Hayden pressed on; now that he'd escaped Carrier's roving eye, he could run an errand of his own.

Mahallan and Martor caught up to him as he was entering the big barrel-shaped axis of the wheel. A sullen local flapped by on ragged foot-wings, and the armorer watched him go. "Who are these people?" she asked. "They don't seem happy to see us."

"Refugees, most of them," he said. "A lot of them will be from Aerie, which was conquered by Slipstream about ten years ago. And some are pirates."

"This is a *pirate* town?" Mahallan laughed in apparent delight as they hand-walked down the top few yards of the yin-yang staircase that led to the rim of the wheel.

Where the curve of the staircase began to flatten out, the rungs of the staircase were replaced with steps, at first impossibly tall ones. As Hayden flipped over and began using his feet, he said, "You asked who these people are. Can I ask who you are? You don't seem to know the first thing about how the world operates, and yet you're our armorer. That's more than a little . . ."

"Odd?" Mahallan shrugged. "It's a fair question. But I'm surprised nobody told you. I'm not from Virga."

"Told you," mouthed Martor behind her back.

"Then where. . . ?"

The nearly-vertical staircase rapidly leveled out as they descended past the town's rooftops. Weight and the familiar, homey sensation of vertigo increased with each step. As she entered gravity, Mahallan seemed to shrink. Her normally cheerful face was clouded by unhappiness.

"Where is a difficult thing to answer," she said. "My world isn't like yours—Oh, I expect you'd think I mean that I come from a planet, with land and mountains and so on." Hayden had never heard either of these words before, but he kept his expression neutral as Mahallan went on. "But the rules . . . of reality . . . you might say . . . are different in my world. Identity and location are very fluid things. Too fluid. Too arbitrary; I prefer it here."

He shook his head. "I don't understand."

"Good," she said with a sad smile. "That means we can still be friends."

They had reached the street. *Down* had made itself forcefully known, and if it wasn't quite perpendicular to the decking but heavily skewed in the direction of the town's rotation, it was still comfort-

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able to Hayden. "That looks like the market up there," he said, pointing.

"Good." Her smile was back. "Let's look for some chemicals I need. They'll likely be lurking in ordinary household materials—"

"Listen, I'll catch up to you," said Hayden. "I need to, uh, use the privy."

"Oh, well, whatever. We'll just be up here." She and Martor walked away, heads leaning together in intense dialog. Hayden watched them go for a minute, then paced in the opposite direction.

The town didn't have a post office as such; the scarred, tattooed, and beetle-browed bartender doubled as the postmaster at the mendicant's lodge. Hayden stood at a stained counter under dim lamplight while he served an old, yammering, and odiferous man with patience and surprising gentleness. When he finally turned his attention to Hayden, he squinted and scowled in open hostility. "Who the hell are you?"

"I'd like to send a letter," said Hayden. "By *irregular* mail."

The man's black eyebrows rose. "Where would this hypothetical piece of irregular mail be going?"

Hayden had thought about what to say on the way into Warea. The sight of a particular tattoo on the bartender's forearm had confirmed his hope about what might be possible here. "It's going to an agency of the government of Aerie," he said calmly. "In Rush."

The bartender's eyes widened. "You're from that ship," he said finally.

"Yes. But I'm not *of* that ship. Listen, I do have money—"

The man's face had taken on a hungry expression. "Save it. Who's this message going to?"

"First of all, I need to know whether you've got someone who can reliably deliver it to an . . . unusual address . . . and speak to no one about the details afterwards."

The bartender leaned his elbows on the creaking wood and got down to business. "What we do, see, is put an envelope in an envelope. First one goes to our man in Rush via the next cutter that trades into the border of Aerie. Your envelope is in his envelope. He only opens it on his way to do your drop. We do it all the time. I can vouch for the reliability of the courier—but there's a hazard pay premium if it's going to be delivered somewhere like, say, inside a jail or barracks."

Hayden shook his head. "Nowhere that special." The man handed him paper and a pen and he began scratching out a note.

"Any way you can satisfy a fellow's curiosity?" asked the bartender as he tried to read Hayden's writing upside-down and in poor light.

"It would probably be worth my life if word went any further than you," said Hayden. "So, no." He grinned up at the man. "But it's for Aerie."

He counted out some coins and slid them across the bar, then folded and sealed the envelope. "Say," he said casually, "do you ever get trade here from the freebooter *Wilson's Revenge?*"

The bartender pursed his lips, then shook his head. "Never heard of it. Friends of yours?"

"Not exactly. Thanks." He stuck out his hand and the bartender shook it. "For Aerie."

"For Aerie."

Hayden walked back out to the street, feeling relieved, and inches taller.

7

The Occupants
Strut Fourteen,
Tromp L'oeil Elevated Platform
Quartet 1, Cylinder 2
Rush, Slipstream
6th Recession, Year 1580 A.V.

Seven ships of the Slipstream Expeditionary Force split off from the main party near the diametric border of Aerie on 1st of Recession. The ships are the *Severance*, the *Tormentor*, the *Unseen Hand*, *Rush's Arrow*, the *Clarity*, the *Arrest*, and the *Rook*. ADMIRAL FANNING IS COMMANDING THE *ROOK*.

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These ships continued on a diametric course outward from Aerie for four days before stopping at the Winter town of Warea. Their destination after this is UNKNOWN, but they are all equipped for Winter navigation and well supplied. The expedition appears urgent. Also aboard are Lady Fanning and an armorer from outside Virga named Aubri Mahallan.

Regardless of the ultimate purpose of this force, its absence from the main body of the fleet may make for a strategic advantage.

Yours,
A reluctant recruit.

By Hayden's reckoning, the ships were making barely fifteen miles per hour—nosing cautiously through the dark clouds, occasionally stalling while the commanders tried to figure out their current position by peering with narrowed eyes at the tracks their gyroscopes had made through tanks of glycerine. Twice great oceans of clear air opened up in front of them. The admiral took the opportunity and ordered full speed ahead. Hayden tracked down Martor on these occasions and took him for rides aboard his bike, opening it up to full speed and once tearing the poor boy loose entirely. Hayden circled back to find him arrowing on through the dark, sleeves rippling in the wind and utterly calm in his certainty that Hayden would return for him.

In the quietest hours of the night watch, he and Martor would meet Mahallan in her little box-shaped workshop. She had them building things—though what those things were, she wouldn't explain. "It's to do with electricity," was all she'd said. The devices (significantly, there were seven of them) were boxes full of metal wires that poked into and through various other, smaller boxes and tubes. Mahallan spent most of her time working on these little containers, filling them with carefully mixed pastes and powders that stank of oils and metal. Every now and then she would get Martor or Hayden to pedal a stationary bike that was attached to a big metal can connected by more wires to one of the boxes; and then she would poke about inside the new device using some metal prods. It was by turns fascinating and boring to watch. So, they whiled away the time by talking.

Both Hayden and Martor wanted to know about the strange outside world where Mahallan was from. At first she wouldn't talk about it. On the third night, as they hovered around one of her strange boxes watching an expanding sphere of smoke extrude out of its side, she sighed and said, "This is the most wonderful thing, for me."

"What's that, lady?" Martor had turned to fetch a leather curtain. She waited as he deftly scooped the smoke into it and glided over to the porthole to squirt it outside. When he returned, she pried open the lid of the box and said, "It's wonderful to me that we can sit here and build things whose behaviors we design ourselves. Like this ship." She patted the wall. "Things like this are made using *knowledge*." She savored the word.

"Don't you have knowledge where you come from?" Hayden asked the question facetiously, but to his surprise, she shook her head.

"No, we don't. Not about the physical world, anyway. The systems of Artificial Nature make it unnecessary for us to know anything." She saw his look of puzzlement and grimaced. "I know, it's hard to explain. That's why I haven't talked about where I come from. Listen, in the worlds beyond Virga, humans no longer have to make things for themselves. Artificial Nature makes them for us. And no two devices or machines are alike; each one evolves in its own pre-physical virtual world. Even two tools intended to do the same job, while they may look identical, might work in totally different ways. And because each device is evolved, not . . . *designed*, is the word you use here . . . no one can say how a given one works. You could spend years studying how one en-

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gine operates, but that wouldn't tell you how other engines necessarily function. So there's no incentive to try. It's been this way on most worlds for thousands of years.

"So Hayden, Martor, you can't begin to imagine the excitement I felt when I came here and first saw two of your ships sailing out of the clouds. They were *identical!* They worked the same way, used exact copies of the same machines. Here were people who could take their own mental models of objects, and make them physically real. Virga is a wonder to me, because here you have knowledge and you use it to make more than one of things. Every time I see a new one of something I've seen before—like these ships—I'm thrilled all over again." She beamed at them. "You live in a very special world."

As she had been speaking, the box she'd been working on had been slowly, strangely, drifting towards one wall. She noticed it and seized it. "*That's* not a good sign," she muttered.

Martor rubbed at his chin, considering. "Is that why you seemed surprised that I'd heard of gravity, the other day?"

The armorer nodded. "Gravity, exactly. Uh . . . yes, most of the worlds I know are replacing concepts like gravity with new mythologies their artists are crafting." Hayden and Martor must have really looked lost at this point, because Mahallan laughed richly when she glanced over at them.

"I'd heard," ventured Hayden, "that the people from beyond Virga live forever, can travel anywhere in the universe, and can do anything."

Mahallan shrugged. "Oh, sure. And that means we have no more need to *know* anything. That's a tragedy. I spent years learning what you call the *sciences,* but it was difficult to find entities who knew how to teach them. Most such knowledge is implicit in the construction of things . . . not written down, as it were. In fact, that's why I came to Virga. It was the one place I knew where there was no Artificial Nature."

"Why is that?"

She leaned forward like a conspirator. "Candesce disrupts the systems of Artificial Nature. It was refitted to do that centuries ago, in order to keep my people's civilization out of Virga. There are side effects that aren't good for *your* civilization, though—and that's why we're building these." She waggled the burnt-out box.

"What do they do?" Hayden had asked this very question a dozen times now, and she'd side-stepped the issue every time. Maybe now that she wanted to talk, she'd give it away.

But Mahallan just smiled enigmatically and said, "They'll help us win."

At that moment there was a knock on the door. Before any of them could move, Venera Fanning poked her head into the tiny chamber. "Aha," she said. "The night-owls are up, as promised."

"Venera," said Aubri neutrally. The admiral's wife swept into the room, frowning as she spotted Martor.

"So, the little spy-for-hire has wormed his way into your good graces. Get out, or I'll have the boatswain chop off your fingers."

Martor scrambled past her and out the door. With a faint smile of satisfaction, Venera closed it behind him. Turning to the other two, she clasped her hands before her and said, brightly, "How is it coming along?"

"It was coming along just fine, until you ejected my assistant," said Aubri.

"Bah!" Venera waved away the problem. "You still have this one. Though not for long—I need him to pilot me tomorrow. We're going on a little trip. You're coming too."

Aubri carefully placed the device she'd been working on in a dark wooden case and shut it. "Where is it that we're going?"

"Our first stop. First official stop, I mean. I want you to come with because you've been here before."

"Really?" Aubri shifted uncomfortably. Hayden thought she looked very unhappy all of a sudden. "Have we circled back

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to Slipstream, then?"

Venera barked a laugh. "You know that's not where I mean. We're coming up on the tourist station! That was your first home when you came to Virga, wasn't it? You should know your way it around pretty well."

"As a matter of fact, I don't. And I don't appreciate being sent back to it without consultation. Unless—" She paled suddenly. "You're not sending me back . . ."

"Of course not, silly woman. I need you to find someone for me—talk to them, make a deal. That's what this is all about, isn't it? Our deal?"

"Yes," murmured Aubri. To Hayden's astonishment, he saw that she wouldn't look Venera in the eye. Venera either didn't notice this, or accepted it as normal. She turned to Hayden, smiling her predatory smile.

"Be ready to fly at eight o'clock sharp. We'll be taking the bike and sidecars, so they'd better be put together."

"Yes, ma'am."

"Good." Without another word, Venera left. As soon as the door closed, Aubri spun and went to the porthole. She yanked it open and stuck her head outside. Hayden heard muffled cursing coming from beyond the hull. "What's going on?"

She pulled her head back in and grimacing at him, gestured at the open porthole. He slipped by her and put his own head out into the cold whispering wind.

For a moment he saw nothing but the usual darkness and clouds. Then with a start he realized that what he had taken to be a giant puff-ball of vapor was made of facets and sweeping curves of glittering ice. They were sailing past a frozen lake: an iceberg as big as any of the cylinders of Rush.

He brought his head back in. "There's an iceberg outside."

Aubri shook her head dejectedly. "Look again." Puzzled, Hayden looked out again. Well, there was the iceberg, and actually there was another one too, on the other side of it. And another—they were attached tip-to-top, making a kind of chain.

A wreath of cloud slipped over and past the ship, and in the opening that followed he saw what Aubri wanted him to see—and gasped.

The *Rook's* running lights reflected faintly from shimmering planes of ice, a thousand angles of it receding into blackness. The ship's cyclopean headlight cast a cone of radiance into the dark and where it lit, Hayden beheld a forest of icebergs. They clung to one another by merest filaments and blades; a dense fog insinuated itself into every hollow and space between them. The *Rook* wove slowly around the giant spires of ice, each giant receding into the haze as others emerged ahead.

Hayden's eye followed a line of bergs as they passed it, and he realized that they thickened and converged miles away until they were jammed together cheek by jowl. Dark crevasses gaped between them. He was reminded of the forest that carpeted Slipstream's asteroid, only instead of the crowns and cones of trees rising up from darkness, here was endless ice.

"It's like a wall," he said. Just then his chin bumped the edge of the porthole. For some reason he'd started to drift into the ship—probably the air pressure.

"It's not a wall," said Aubri sourly. "It's a ceiling. *The* ceiling, to be precise."

"The . . ." He got it then. "This is the world's skin?"

"The skin of the balloon, yes. Everything else in Virga is below us here. That's why we're feeling gravity. I should have realized it from the way the engines were straining."

In the distance a thunderous *crack!* echoed through the berg forest. Hayden looked out again, and beheld a mountain of ice majestically disengage itself from its neighbors. He watched it as it faded into the ice fog behind them; he was almost sure he could see it moving away from its brothers.

"Candesce drives convection currents in Virga," said Aubri, startling Hayden be-

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cause she was right next to him, just below the porthole. "Rising water vapor condenses into lakes, and if it makes it all the way up here, it freezes. The skin of Virga is very, very cold. But the skin is also the top of Virga's gravity well, slight though that may be. As these bergs grow they become heavy. Eventually they dislodge and fall, melting as they go. The biggest of them make it almost to Candesce before they evaporate."

Hayden contemplated the gargantuan icicles—for that was what they were—for a long time. Then he drew his head into the ship and said, "Why are we here?"

Aubri's face was only inches from his own. He had never been this close to her, and it gave him an uncomfortable pleasure—but she was looking miserable. "What's wrong?"

She pulled herself back to her workstation and fiddled with the lamp for a moment. "If I'd known we were coming here, I wouldn't have joined this expedition."

Hayden crossed his arms and waited. After a few seconds, Aubri sighed heavily and said, "Look, I came to Virga to get away from *that* world." She jabbed a thumb hullward, aiming, he supposed, past the skin at the universe beyond. "I'm a refugee here, and I don't like to be reminded of what I left. Even less do I want to revisit that insipid tourist station."

He descended to sit on the air next to her. After musing for a few moments, he said, "I think I understand. I was born and raised in Aerie. Slipstream conquered it when I was still a boy. But I remember it—and there's reminders of it everywhere you look, from the crafts they sell in the market to the accents of people in the streets. They're . . . painful. You start avoiding them. And then you feel guilty about it."

She shook her head. "It's not like that. Not quite like that, but yeah, I don't like to be reminded." She smiled suddenly. "I didn't know you were from Aerie."

"Well, neither did anybody else before tonight," he said, clasping his hands in front of him. "Are they going to know by morning?"

Aubri raised an eyebrow. "No—no reason why they should."

They sat in companionable silence for a while. Then a faint shudder went through the ship, and simultaneously the whine of the engines changed tone.

Aubri groaned. "Are we there already?"

The howl of the alarm klaxons drowned out any reply Hayden might have had, or any thought. He bounded to the window and looked out, in time to see bright streaks converge on one of the other ships from inside a vast cloudbank. Bright flashes lit the side of the ship. He was able to close and dog the porthole before the staccato noise of explosions reached the *Rook*.

"We're under attack," he said unnecessarily, but there was no reply as Aubri Mahallan had already left the room.

Chaison Fanning threw on a jacket while an aide with a hand on his back steered him through the connecting passage to the bridge. Behind him the whole ship was awake and churning with activity. "How many are there?" he shouted ahead at the suddenly alert nightwatch. "What weapons?"

"Admiral, it looks like Winter pirates," said the frightened-looking Helm. He was a junior officer on one of his first watches. Probably more afraid of messing up than of the enemy.

Chaison glided to the main periscope and took hold of its handles, slipping his feet into the stirrups below without having to look for them. For a few seconds he blinked, trying to figure out what he was looking at. Then practiced reflexes took over and he began counting and evaluating.

"I see ten enemy craft. It's a whole fucking fleet. I bet there's more maneuvering inside that cloud bank."

"Somebody at Warea must have told them about us," said Captain Sembry from behind him. "We're probably the biggest prize that's ever wandered into

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their territory."

"It's pure foolishness—they're not a navy, just a ragged flock of crows. What makes them think they can outmaneuver us?. . . Ah." He laughed humorlessly as he made out more details of the distant ships. "Some of them look like Aerie frigates. I take it back, they're not after booty. At least some of these people are carrying a grudge."

He spun and offered the periscope to Sembry. "Captain, it's a classic night engagement. They've got us trapped in the center of a cylinder of cloud. Their ships have plumbed those clouds, and I don't doubt at all that there's some big icebergs lurking in there if we were foolish enough to follow them. They're going to hit and run out of the fogbanks because they know what's inside them. We have to take away that advantage."

He turned to the disheveled but alert semaphore team. "All ships: launch bikes. Bikes to reconnoiter clouds, not to engage enemy unless attacked. All ships: rolling torus formation. All ships: ready rocket barrages, fire at will."

Chaison went to a porthole and threw back its thick armored cover. Icy air flooded his face as he looked out at the scene.

I told them Aerie should be left alone, he thought as more rocket explosions lit the night. *The Pilot of Slipstream is an idiot.*

"Civilians to quarters!" The botswain waved his sword at Hayden for emphasis. "That means you, errand boy. And strap yourself in—we're going to be pulling heavy maneuvers."

After a few moments of hesitation, Hayden retreated back to Mahallan's workshop. This was probably the only place in the ship where he'd be left alone. He nearly missed his grab for the door as the entire vessel shuddered. The sound of the engines was momentarily deafening, and a squeal of seldom-used brakes echoed from the fore. They were stopping the centrifuge so the *Rook* could maneuver without having to take gyroscopic effects into account. Somewhere in the distance he heard crashing sounds as the personal effects of dozens of airmen slid and tumbled inside the wheel.

He stuck his head out the porthole, wary of getting it shot off. What he saw was a jumble of ships, lit intermittently by rocket fire, moving at all angles to one another with no way at first to tell friend from foe. Some of those silhouettes were familiar, however. Hayden knew the sleek forms of the Winter pirate vessels all too well, having spent some time on one of them during the years of his exile. He'd lied when he told Miles and the other resistance fighters that he'd spent all his time sitting on a mushroom farm in the middle of nowhere. The truth was more dangerous to admit.

More details resolved as his eyes adjusted to the darkness. Clouds of bikes were tumbling out of the ships now, their tearing buzz filling the air as they swarmed around one another. The whole tableau was framed by black cloud banks that pressed in on all sides. And now a huge frigate emerged as if by magic from one of those clouds, tongues of red fire erupting from its side as it fired a salvo of rockets point-blank into the stern of a Slipstream vessel. A good half of the rockets bounced off the cone-shaped end of the ship, drawing scarves of light on the darkness, but the remainder exploded. Beams and planking flew everywhere. The pirate rolled, jets screaming, and lined up its dorsal rocket battery. This time the bulk of the volley shot straight down the length of the Slipstream ship's exposed interior. A chain-reaction of explosions convulsed the victim and then the clouds flashed into flame-lit visibility as the ship burst like an over-ripe fruit. Men and materiel tumbled into the cold air while thunder banged and rolled around them.

Hayden smiled in grim satisfaction. That was one less Slipstream ship. On the other hand . . . he suddenly realized that the expeditionary force might lose this battle. If they were overwhelmed, there would be no prisoners taken. Everyone

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would be killed, from Admiral and Lady Fanning to Martor and Aubri Mahallan.

He would cheer the deaths of the Fannings—or at least of the admiral. Venera . . . he didn't know what to think of her. But her fate was out of his hands, he realized with a pang. She would never agree to escape with him. But maybe he could convince Martor and Aubri Mahallan to climb into the sidecars of his bike. They could arrow out of here, make for the tourist station, which he could now see through a gap in the clouds. It was miles away yet, an inverted, glittering landscape of towers; a city not rolled into cylinders but flattened out across the black ceiling of Virga.

They could make for that swirl of light. They could survive.

He turned and bolted for the workshop's door.

"Who knew there were this many pirate ships in all of Virga?" muttered a crewman. Chaison Fanning didn't acknowledge the comment, but he'd been wondering the same thing. Had they gathered this fleet from all over the world, just to attack his little expeditionary force? Right now it seemed that Winter really was the vast dark empire of freebooters and privateers that some popular stories and songs made it out to be.

Unbelievably, they'd already lost *Rush's Arrow*. The effect of the ship's explosion on the men had been immediate and dire. Chaison was now on his way through the ship, hurling orders and optimistic quips to the men as he went. He needed them to know that he trusted Sembry to command the *Rook*, and that his primary concern was them. But he was followed by a stream of staffers and he paused at every porthole to stare out at the battle, and occasionally issue a terse order for the semaphore team.

He stuck his head into the bike hangar. The place had been emptied out, all bikes in the air except for Venera's absurd racer with its sidecar, which her driver was laboring over. The hangar doors were wide open and men with rifles perched on them at various angles, haphazard gargoyles ready to fend off any comers. On his orders the ships had tossed out flares and so the clouds outside were lit a lurid green.

Actually, the view from here was excellent, better than the bridge, even. Chaison leaped over to one of the doors and anchored himself next to a surprised airman. "Do you have any more of those?" he said, pointing to the man's rifle. "I'm aiming to take some personal vengeance for the *Arrow*."

The airman grinned and shouted back, "A rifle for the admiral, boys!" One was passed up, the last several hands being those of his staffers, who looked uneasy and disapproving.

He motioned for them to join him. "Run a speaking tube from here to the bridge," he said. Just then the *Rook's* rotation brought the black-sided hull of a pirate corsair into view. The ship was less than three hundred feet away—he could see lights through its open rocket ports.

"Hit that ship!" he yelled, and opened fire with his rifle. The men cheered and a satisfying volley erupted around him. Moments later the bright darts of rockets followed from the *Rook* and from somewhere behind it. That would be the *Severance*, he guessed, which should be in triad formation with the *Rook* and the *Unseen Hand*.

"Concentrate your fire on the engines!" He squeezed off several shots to demonstrate. In a battle like this, you kept moving, but you were also rolling the ship constantly to bring the rocket batteries to bear on the enemy. In order to do this, the ship had to stick its engine nacelles out and turn them ninety degrees; this made them vulnerable to rocket and small arms fire.

The *Rook* was rolling now and it made for a bit of gravity; Chaison had to turn himself around and cling to the hatch because *out* was now *down*, and he was firing past his own feet. This was why you lashed yourself to any handy ring during a

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battle. You could easily fall out of the ship.

As the hangar rotated out of sight of the corsair, Chaison caught a glimpse of one of his bikers plunging in from behind it. The man held a grenade over his head and as he passed the corsair at over a hundred miles an hour, he threw it. The green-lit ball disappeared into one of the corsair's engines and it blew up, just as the out-thrust hangar doors cut off Chaison's view.

But now the rest of the battle swung into sight again. *Tormentor, Clarity* and *Arrest* had good crews and had maintained their triad even though they were surrounded now by six ships. One of those ships was on fire and as Chaison watched, it veered away into the safety of the clouds. A coordinated volley of rockets from the triad enveloped another pirate and its sides buckled under the explosions. Silent and dark, it began to drift.

The ships and cloud-banks were lit flare-green, but now yellow and red lights also glowed inside the clouds. Those were locator flares his bikes had dropped where they'd found ice or other hazards inside the mist. The bikes should be returning now. He turned to his staffers. "All bikes: attack enemy at will. All ships: mine the clouds."

Seconds later he heard the satisfying "heave ho!" of the *Rook*'s crew winching back the mine catapults. The buzzing snarl of jets grew louder as bike formations began to appear, swirling into the disorganized knots of the pirates' own jets.

The roar of a bike sounded, very close. It might be one of the *Rook's* boys coming back, maybe wounded, or— He swung down and looked around the edge of the hangar door. Not thirty feet away, a black can trailed flame as it tried to match the rotation of the *Rook*. Its rider wore a lime-green jacket and burgundy trousers. He was straining to snag a passing porthole with a hook lashed to a grenade.

Chaison leaned way out, standing now on the very bottom of the open door with only a rope around his waist tying him to the *Rook*. He aimed and fired in one motion, and saw the rider convulse and the bike veer away. Before he swung back up he verified that the grenade had followed them into the dark.

Dangling there, vaguely aware of cheering coming from up above, he watched the battle progress. His forces had a clear advantage in weaponry, armor, and discipline, but they were outnumbered. The pirates—or expatriate Aerie airmen—kept swinging in and out of the cover of the cloud banks. They had men on bikes tracking down the flares Slipstream's own bikes had laid down; as Chaison watched, the glows that marked the location of obstacles in those clouds were snuffed one by one. Having previously set the positions of those ice- and rock-chunks in their inertial navigation systems, the pirates themselves had no need of lamps to know where they were.

Another swing around and the *Severance* and the *Unseen Hand* appeared, locked into a fierce rocket battle with three black cylinders. Their formation was broken and the two ships were drifting away at a quickening pace. As Chaison was about to ask why Sembry wasn't pursuing them, the *Rook's* rotation took them out of sight, and something huge cut off any further view of the sky.

It was the black hull of a pirate, and it was barely yards away. The bastard had somehow snuck up on Sembry. Looking to the side, Chaison realized that the pirate had already looped rope around the spinning *Rook*. If friction or snags didn't break them, the pirates could drag the *Rook's* hull into contact with the jagged rams that were even now being thrust out of its rocket ports.

"Sembry!" roared Chaison. He'd have the man towed for a day behind his own ship for this. The riflemen around him were gaping, so he yelled, "Fire on those ports!" and did so himself as an example.

Then he turned to his staffers. "Ready the ship for boarders. And find out why Sembry's not moving us!"

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"It's mines," somebody said. "They've mined the air between us and the others."

Sure enough, as the ship spun around again he caught glimpses of green-lit star shapes tumbling in the space between the *Rook* and the receding *Severance*. "I need those cleared!" Even as he said this, he realized that none of Slipstream's bikes were nearby. The bulk of them were caught up in a gigantic dogfight at the opposite end of the battle. Some drifted, dead or burning. The rest were missing.

He whirled and pointed at Venera's driver. "You! Get out there and clear those mines."

"W-what?" The young man blinked at him dumbly. Of course, he was just a civilian.

Chaison appealed to the riflemen. "Anyone else here can fly a bike?"

"No, wait, I'll do it." The driver was glaring at Chaison as though he'd received a mortal insult. "But . . ." The black-haired young man glanced to one side, almost slyly. "I'll need help." He indicated the bike's two sidecars.

"Whatever," said Chaison with a negligent wave of the hand. "Take whoever you need.

"Bring me a saber and a pistol," he said. As he waited, he watched the driver manhandle his bike towards the open hangar doors. *Venera's not going to be happy if I wreck her nice little taxi*, he thought. The idea made him smile.

8

"Martor!" Hayden waved frantically as he saw the boy pass the inside door to the hangar. "Get in here!"

As Martor swung into the hangar, Hayden grabbed him by the arm and aimed him at the bike. "Was the armorer with you?" he asked. Martor nodded. "Get her. Fast!"

He did his best to be slow about winching the bike over the open doors. Every few seconds, the scarred hull of the pirate would flash into view and the ships would exchange rifle fire. Bullets hummed past on all sides when that happened and Hayden hid behind the substantial metal of the bike.

When he poked his head out the third time, he saw Martor literally dragging Aubri Mahallan into the hangar. "What's this all about?" she asked impatiently as the two came to land on the sidecars.

Hayden turned to Martor. "Strap yourself in. We're going for a little ride." The boy looked startled, but climbed into one of the sidecars without comment.

He turned back to Aubri. In a low voice he said, "We're going to lose this battle. Come with me if you want to live."

Her eyes widened. She glanced at the opened doors below them just as a black hull appeared there. "Down!" Hayden grabbed her shoulders and pushed her into the open mouth of the bike's jet as gunfire sounded all around them. Abstractly he noticed how fine-boned her shoulders were. Behind them, two of the *Rook's* riflemen convulsed and tumbled forward to hang at the end of their lines.

Aubri cried out and covered her eyes.

"We have to go," Hayden said to her, "and we have to go now! The *Rook's* about to be boarded. You have no idea what they're going to do with a woman if they catch you."

The gunfire subsided as the pirate swung out of sight again. Aubri Mahallan looked out at the bullet-scarred space, its air blue with gunsmoke, and bit her lip in obvious indecision. Then she pushed Hayden aside angrily. "Get out of my way," she hissed. "I'm needed here."

"What are you talking about? You'll be killed if you stay!"

"So," she said coldly. "You really are just a driver, aren't you? Haven't the backbone for a real fight?"

"You have to choose your battles, Aubri."

"Fine. I choose this one. You run away, if that's what you want."

Hayden was too astonished to stop her as she jumped back up to the inner door. At the same time, another heavy body landed on the bike next to him, making it

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rock. "Hey!" shouted the red-haired botswain, who held a bundle of rope and rockets under his arm. "Cut us loose, errand boy!"

Hayden cursed and mounted the bike. He glanced down to make sure the pirate wasn't below them, and then pulled the pin on the winch. The bike did its curving fall into the dark air, and he spun up the fan and lit the burner without thinking.

His two passengers were having a shouted conversation past his back. "—Tied to the nets," said the boatswain as the jet lit and they surged forward just in time to avoid the approaching hull of the pirate. "Snag a mine with the net and light the rocket. Make sure you aim the rocket away from the *Rook* first. If you can aim it at a pirate, great!"

The boatswain spun in his seat and hit Hayden in the midriff. "Get us out there, you fucking coward! The *Rook's* about to be boarded!"

Hayden complied silently. This bike was dangerously fast, even with sidecars on it, so he was compelled to approach the mined air in a series of short bursts. This drew more insults from the boatswain. Meanwhile the battle continued to rage around them, at near points such as the *Rook*, and far away in flashes like lightning on distant clouds. Grumbling and roaring noises echoed strangely off the ice field that made a half-visible wall beyond the mists.

In the light of flares that Martor held over his head, the first mine hove into sight just yards ahead. Hayden puffed the engine a couple of times and the boatswain leaned out with his net to encircle the studded metal sphere. The net was tied to a rocket the length of his forearm; the boatswain lit it and the bike was showered with sparks. Hayden shielded his eyes for a second then watched as the rocket surged away, towing the mine into Winter.

"Next!" roared the boatswain. Hayden turned the bike, glancing back at the *Rook* as he did. It and the smaller pirate seemed locked together now and men were spilling into the air between them.

He looked in the opposite direction. Far out there, the glittering lights of the tourist station beckoned. There was life for Martor and Aubri, if only he could figure out a way to get her off the *Rook*.

It was too late for her, he realized with a pang. But not for Martor.

The boatswain fired off another rocket. "Next! We've got to clear a tunnel for the *Rook* to fly through!"

"All right, all right!"

Hayden's heart was pounding. It was happening again: start to know someone, and all you got was the chance to lose them. True, he barely knew Aubri Mahallan. And true, a month ago he'd been willing to sacrifice his own life just to strike a blow against Slipstream. His most hated enemy was fighting for his life in the *Rook*, and Hayden should fervently wish nothing but disaster for that ship and all aboard it.

But he'd flown out from Gavin Town with a rifle in his hand and shot at Slipstream's cruisers while his mother decided her own fate in Aerie's unlit sun. And as Hayden had tumbled helplessly away into Winter, she had died. Was he really going to let Aubri go in the same way?

He swore, twisting his grip on the bike's handlebars. "Next!" yelled the boatswain and he turned the bike to find another glint of green in the light of Martor's flares.

Momentarily, he had an audience's grand view of the battle. Slipstream's ships were giving better than they took and several pirates were now drifting hulks surrounded by clouds of debris and dead men. The superiority of Fanning's disciplined crews was beginning to tell. The problem was that the pirates were able to use the cover of the clouds; they emerged just far enough to fire off a salvo, then retreated into invisibility.

Now that he could see the whole vista, though, Hayden realized that the pirates were only hiding in the clouds on one side—the side where the icebergs lay hid-

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den in mist. They could use those bergs safely because the things didn't move—they were really giant icicles hanging from the outer skin of Virga. He had seen one of them begin a slow majestic fall just before the battle.

That gave him an idea.

"Next!" He looked around. There were dozens of mines, and there was no way they were going to clear a path for them before the boarding action on the *Rook* was decided one way or another. He turned toward a nearby mine, but made sure that he brought it up to the bike on Martor's side. "You take it, rat," said the boatswain as he handed Martor a rope and rocket. The boy grinned fiercely and leaned out to lasso the mine.

Hayden pulled out his knife and cut the strap tying the boatswain to his seat. The man was watching Martor and didn't notice. Then Hayden took a net and threw it over the boatswain's head.

"Hey! You bastard, watch what you're—"

Hayden lit the rocket tied to the net just as Martor was lighting his own. Sparks showered everywhere and they both ducked down covering their eyes. When Hayden looked up again, both the mine and the boatswain were gone.

Martor stared at the empty seat. "Where'd he go?"

"I don't know." Hayden spread his hands, looking surprised. "One second he was here, then he was gone. Must have caught a stray bullet."

Far out there, if you knew where to look, the fading ember of a rocket poked into a cloud bank and disappeared. Hayden watched it go, then turned to Martor. "Listen," he said, "this isn't going to save the *Rook*. I've got a better idea."

He took them over to the next mine and Martor netted it. "Don't light the rocket," Hayden told him. "Just string it out behind us." They did the same with the next mine, and the next. Soon they had five of them dangling in their way.

"Now we get out of here," said Hayden.

"But the admiral told us to—" Martor hastily grabbed the sides of his car as Hayden put on the power. They shot up and away from the mined air—and the battle—heading straight for the mists that hid the bergs.

"Light more flares. We'll need to see where we're going." He slid them into the clouds at an incautious speed, trusting to his own skill to avoid hitting anything. The flares made a sphere of leaf-green light around them, and only the occasional wisp of moisture fluttering past showed that they were moving at all.

It was freezing in here, and Hayden took inspiration from that: follow the chill. He slowed the bike and let it drift in the air currents until he felt it enter a river of cold. Then he cautiously nudged them forward.

Out of the darkness, a vast turquoise shape emerged—a long, sleek, fish-shaped mountain of ice covered with knobby protuberances. Hayden could make out its tip off to the right, a dangerous white spike intermittently lit by distant explosions. To the left, the shape wove off into blackness.

He wrestled the bike in that direction. Martor was silent now, puzzled but obviously intrigued. As Hayden circled the berg he saw what he was looking for: there was a spot where the giant icicle narrowed to a thickness of only a few yards. In the minuscule gravity created by Virga's collective air and water, this neck was enough to hold up the rest of the bulk.

"Martor, I want you to fire a mine at that crimp there." He pointed. Now the boy's eyes widened with understanding and he hurried to obey.

Hayden ducked away from a cascade of sparks, then looked up to see that Martor's aim was good. The mine sailed silently at the ice, contacted it, and—

—A flash of orange lit the night and moments later the thunderous bang of the explosion made Hayden flinch. As the smoke cleared, he saw that the neck of ice had been severed. A white splinter shot past his head, barely a foot away, but

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he hardly noticed. He was watching the gap that now existed between the ice attached to Virga's skin, and the long berg that had hung down from it.

"It's widening," he said after a few seconds. "Martor, do you see it? It's starting to *fall*."

The boy grinned. "Let's do another one."

The ship was a madhouse full of screaming, gunshots, and the clash of swords. Chaison Fanning had his sword out, but his staffers were in the way. One of them interposed himself between Fanning and the silhouetted form of a pirate whom he was about to attack.

Fanning had a savage moment in which he considered stabbing the man to get at the pirate. What he needed above all else was to take the heads off a few of those swine who were threatening his ship, his men, and his mission.

Fanning slipped past the well-meaning fool and his sword fight, and dove for the hangar. A knot of men was struggling unsuccessfully to prevent the pirates from gaining access to the ship proper. Fanning flew over to join them, being careful to look past the heads and struggling arms in his way and assess the enemy. The hangar was mostly full of low-lifes and bullies who were unused to an even fight, but they seemed to be led by a tight vanguard of ex-Aerie naval officers who had thrown themselves across the space between the ships with no regard for bullets or blades.

"Shoot the leaders!" He grabbed a rifle and aimed past a pair of men who were fighting a free-fall sword fight, blade in one hand, long curving belaying hook in the other.

"But sir!" The damned fly who'd buzzed around him earlier was back, panting but unscathed. "What about the fleet? Your orders?"

He whirled, murderous rage causing him to level the rifle at the man. To his credit, the officer paled, but stood his ground. "They need an order," he said.

Fanning cursed and grabbed him by the throat. "Don't ever," he hissed, "make the mistake of thinking I can't fight and plan at the same time." Then Fanning dove past him, making for the bridge.

The way was blocked. He blinked in surprise at the staved-in beams and boards that filled the narrow passage beneath the centrifuge. That didn't look like rocket damage. A prow? Had they been rammed while he was looking the other way?

It hardly mattered. He pried some planks out of the way and stared out at the dark. The battle was going much as he'd expected; the pirates had the advantage of available cover and were using it shamelessly. But the five ships on the other side of the mined zone were making mincemeat out of them anyway. *They don't need my help*, he decided. Taking a moment to run down his list of priorities, he turned to the staffers and said, "Where's my wife?"

"Uh, the bridge, sir."

"All right. We're going to have to get there; that's where the scuttling triggers are located. Time to do a little outside climbing, boys."

He kicked at the broken planking and soon had made an opening big enough to worm through. The staffer who'd confronted him earlier put a hand on his arm as he made to go through it. "Let me go first, sir. We don't know what's out there."

Fanning stopped in surprise. "What's your name?"

"Travis, sir."

"You've got a fine sense of propriety, Travis, but you're a bit impertinent." Travis looked crestfallen and Fanning laughed. "Get going! We'll talk later."

Travis made it outside and apparently didn't die; his hand reached back through the gap to help Fanning and the other staffers clamber out. They found themselves at the bottom of a huge dent in the *Rook's* hull. Nothing that the carpenters couldn't take care of, though. Fanning looked out and saw that both the *Rook*

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and the pirate had stopped spinning. They were lashed together now by dozens of ropes. The nearest hatches on the pirate were twenty feet away, and while men were popping out of those every few seconds, none looked forward and spotted Fanning's small group. It was tempting to start picking them off, but that would be a fool's game. They wouldn't last a minute before somebody sniped them from behind a porthole.

"There's a fine irony," commented Fanning as he groped for purchase on the streamlined hull. All around was nothing but air, the endless abyss of Virga; a misgrab here would send you on a slow trip round the world, with the birds, bugs, and fish making a moving feast of you along the way.

"What's that sir?" Travis appeared next to him. Both of them clung by their fingernails to the gaps between hull planks, moving themselves forward with slow swings so as not to lose that purchase.

Fanning shrugged and said, "We came out here to find a pirate's treasure, but it looks like we're going to become such a treasure instead."

Travis nearly lost his grip. "Pirate's . . . *treasure?* Admiral, sir, what are you talking about?"

Fanning gazed past him. Another of his ships was disappearing behind a pall of smoke. He doubted that it was a deliberate ploy, it wasn't evenly enough distributed. That did not look good.

They were approaching the portholes to the bridge. There was an impenetrable hatch there; they would have to talk their way in. *Shouldn't be hard*, Fanning thought absently. *Venera's not mad at me for anything at the moment.*

He risked another glance at the battle. Yes, that was definitely the *Clarity* on fire out there. Three pirates had it under sustained attack. They were using a wheel formation, he saw—that was far too sophisticated a maneuver to be undertaken by untrained privateers. The three ships had let out ropes and tied them together at a central point. With their engines on full they'd begun to spin around that central pivot point. Spinning up like that was easy; it was a standard way for groups of ships that lacked centrifuges to create gravity while on long voyages. What was hard was spinning and twisting while you spun to present a difficult target to attackers. These ships were doing that.

Two-thirds of the wheeling formation were inside the cloud bank. The net effect was that a pirate would swing out of the white wall at a fierce clip, fire a volley of rockets, and then peel back into the mist in a much steeper turn than would normally be possible. The *Clarity* was firing rockets at the center of the formation, hoping to cut the ropes that held the three ships together. That was a long shot, however.

Travis had given up asking about the treasure and was pounding on the armored hatch. Fanning hardly noticed, mesmerized as he was by the drama unfolding in that distant patch of sky. *Get out of there*, he willed the *Clarity*, but its engines must be damaged. It was a hanging target, like a driver fallen off his bike and vulnerable in clear air. In seconds it could all be over.

The cloud bank pulse orange once, twice, then dozens of times in rapid succession. Fanning had seen fireworks reflecting off clouds; that was what this looked like. He'd been mentally timing the appearance of each ship from within the clouds, and the next one was late. No, not late—it wasn't coming out. Seconds passed, and the second of the three should have appeared, but it didn't.

Finally one appeared. The pirate left the cloud bank in an uncontrolled tumble. Flashes of rocket fire showed long streamers of rope trailing behind it.

"They hit something," he said. Travis looked up, puzzled. Fanning pointed, and as he did so another flash lit the clouds, this one miles away.

"Somebody moved the icebergs," he whispered. Then he started to laugh. Two spokes of the wheel had been lost within seconds—two pirate ships flown at full

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speed into an unexpected obstacle. The fools were too confident in their charts, and now they were blindly running into the mountains of ice they had been using to hide their maneuvering. It served them right.

"*I don't see what it is you find so amusing about the situation*," said a cold voice behind Fanning.

"Travis, cease your work," he said quietly. Turning, he raised his hands. "We have visitors."

Venera Fanning crouched on the inside of the bridge's hatch. She could hear voices outside; one had sounded like her husband's. Captain Sembry refused to undog the hatch, however, and she didn't have the strength. The damn thing was designed to resist an invading force. Opening was about the last thing it was capable of doing.

Rhythmic pounding came from the inner doors as well. A minute ago an explosive charge had gone off behind one of those doors, but it hadn't been enough to break the hinges. It was only a matter of time, though.

Well, she thought, *this will be an interesting new chapter in my life. Captured by pirates!* The prospects of various fates worse than death outraged and angered her, but Venera wasn't afraid. She was already wondering what leverage she could use to make the best of the situation.

"The gas?"

Venera came alert at those words. She looked over at the bridge crew, who were clustered around a set of valves and pipes at the back of the can-shaped chamber. Captain Sembry was shaking his head at whoever had spoken.

"Too late for that," he said. "We'd kill the boarders, but the rest of the pirates would just blow the stuff out and come in again."

"The charges, then."

Sembry nodded, reaching into his jacket for something.

"Captain?" Venera put on her best maiden-in-distress act. "What's happening?"

Sembry turned, looking patriarchal and sad. "I'm sorry, dear," he said, "but we can't allow a Slipstream ship to fall into enemy hands. I'm going to have to scuttle the *Rook*."

She widened her eyes. "But we'll all be killed, won't we?"

He sighed. "That is the nature of military service, I'm afraid."

"How do you scuttle a big ship like this?" she asked.

Sembry showed her the key in his hand. He nodded to a set of metal boxes on the wall behind him. "These charges can only be set off by electrical current," he explained. "This key—"

He blinked in surprise at the pistol Venera had produced from inside her silk pantaloons. Sembry opened his mouth to speak but Venera never learned what he might have said, because at that moment she shot him in the forehead.

The rest of the bridge crew was nicely packed together, and consequently picking them off was just as easy.

Twitching bodies and drops of blood caromed around the bridge. Venera ducked through it all and grabbed Sembry, who still had a surprised look on his face.

First order of business, she thought: *dispose of this key.*

Second: open the doors and let in the pirates.

His plan had worked. Hayden and Martor hovered high above the action, at the only spot he'd found where they could see past cloud, contrail, smoke, and darkness. Four icebergs were nosing out of the mist now, trailing fog as they slowly gathered momentum in their long fall towards the Sun of Suns. The pirates had lost their advantage and were in disarray. The battle might have turned.

Something he hadn't anticipated was happening, though: as the icebergs fell, they brought their weather with them. The battle scene was fast disappearing in a vast billow of cloud. Already foghorns were sounding through the dimness as

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the ships struggled to avoid one another.

Martor was squirming with impatience. "Now back to the *Rook!*"

Hayden nodded and spun up the engine, but he was uneasy. With the ships separated by mist and mines, it could be a long time before the *Rook* was relieved. He nudged them cautiously through the layers of mist, listening for the sound of gunfire or rockets. Ominously, he heard nothing.

A black hull loomed up suddenly and he had to spin the bike and hit the gas to stop in time. "It's the pirate!" said Martor as he groped for the sword he'd stowed in the sidecar. "Sounds like we've won!"

Hayden eased them around the hull, as quietly as he could. The pirate and the *Rook* were still bound together with rope, and lights burned in the portholes of both. He could see the gray shapes of men working on the *Rook's* engines, so the fight must indeed be over.

Martor was nearly bursting. "Come on, what are you waiting for?"

"Shh!" Cutting the engine entirely, Hayden let them drift towards the aft of the ships. The working figures resolved slowly, like images he'd once seen on a photographic emulsion.

"Hey, those aren't—" Quickly Hayden grabbed Martor's arm, putting a finger to his own lips. The boy pulled away.

"But that can't be! We have to do something."

"Martor, they've taken the *Rook*," Hayden whispered. "We can't go back now."

"What are you talking about? This is the *perfect* time to go back. They won't be expecting us. We can catch a ride on the hull, like tired crows, and when they least expect it—" Hayden shook his head.

Martor tried again. "Then let's hang back in the clouds and follow them . . . What?"

"We have another ten minutes' worth of gas, tops. If they aren't out there already, the pirates are going to send out bikes any minute now to look for any followers. And you know perfectly well they'll check every inch of the hull, inside and out, for stowaways."

"You want to run back to one of the other ships? No! I'm staying to fight."

"Martor, that's ridiculous. You wouldn't last ten seconds." Let the boy think they were returning to the other ships. By the time he realized that their true destination was the tourist city, it would be too late.

Hayden felt sick at the thought of leaving. Consigning Aubri Mahallan to these monsters was another defeat in a lifetime of defeats. And for some reason, the thought that Admiral Fanning was dead or soon would be, was no consolation. *Who cares about him?* some unexpected part of him said. *Only you, and what do you matter?*

"I hate to do it," he said sincerely. "But we've got to—"

He glanced up just in time to see the black cylinder of a rocket, held in Martor's hands, swing towards his face. Then everything burst and went dark.

9

When Venera Fanning was a girl, she lived in a room with canary-yellow walls. Little trees and airships were painted on it, and her bed had a canopy of dusty velvet and sat against one wall.

At night, if she pressed her ear to the uneven plaster, she could hear the screams of men and women being tortured in her father's dungeon.

She'd been reminded of home many times over the past day. Now, though, the sounds of screaming echoing through the *Rook* had died out. In the relative silence that followed, she could hear someone big approaching through the lamplit dimness—whoever it was, was banging back and forth off the walls in a freefall tantrum. As the figure passed the doors to the hangar where Venera was tied up, she saw that it was the pirate captain, Dentius was his name. It was apparent that he wasn't pleased with the results of the torture session.

Venera took the opportunity. "By now," she said loudly, "you'll have noticed that the crew have absolutely no

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idea where we were going."

Dentius whirled. His already small eyes narrowed further and his lips pulled back from his teeth. Swinging into the hangar, he stopped himself by wrapping his legs around Venera's hips. He grabbed her by the throat.

"What do you know?" he shouted. "Tell me or you're next."

"Now, Captain," she croaked, rearing back, "there are easier ways. I'm quite willing to tell you . . . for a little consideration."

He sneered. Dentius wore the faded and patched uniform of an Aerie ship captain. His face, however, bore no traces of ever having been exposed to sunlight. Like most of his crewmen, his skin was as white as the inside of a potato, except where it was criss-crossed with pink scars. To Venera he looked like some giant, writhing grub stuffed into an officer's jacket.

She knew he was already inclined to treat her differently than the crew, who were mostly crammed into empty rocket racks or water lockers, out of sight and momentarily out of mind. Whether Chaison was with them, or whether he even lived, she had no idea.

Venera and Aubri Mahallan were tied up and on display in the hangar, "as an inspiration to the lads," Dentius had said—though both were still clothed because, he'd said, "there's a fine line between inspired and obsessed." Still, Mahallan was lashed spread-eagled in the center of the space and seemed dazed and despairing. Venera merely had her wrists fastened to a stantion near the door.

It was clear what the captain had in mind for Mahallan. If he had no clear idea of what to do with Venera, she wanted to provide him with some alternatives before he thought about it too much.

He peered at her for a moment, then sucker-punched her in the kidneys. The pain was astonishing—but through Venera's mind flashed a memory of herself lying on marble tiles, moaning through a ruined mouth and staring at the blood-shrouded shape of a rifle bullet that lay next to her. While nobody came and her fury grew and grew . . .

Dentius grabbed her hair and pulled her head back. "Tell me!" he roared at her. "Or I'll kill you right now!"

"Th-that's the problem, isn't it?" She managed to smile, though her neck and jaw pulsed with pain and she could feel the hairs in her scalp starting to pull out. "You're going to kill me anyway. So why should I cooperate?"

Dentius grunted and drew back. He had the mentality of a shark, she'd decided: all straight-ahead brute force, but stupid and immobile when stopped. Her bravado seemed to have stymied him—or at least, it had reminded him of what she'd already done.

"Why'd you shoot the captain?" he asked suddenly.

Venera smiled. "Why? Because he was the one other person on board who knew our destination."

Dentius let go of her hair. At that moment one of his obsequious mates appeared in the doorway. "Inventory's done, Captain," he said in a familiar accent she couldn't quite place. "Strictly military, except for some paintings. Probably going to trade those at the voyeur's palace."

Dentius nodded, eyeing Venera speculatively. Then he drew a knife out of his boot. She drew back, but he merely reached up to cut the length of rope holding her to the beam. "We'd best talk further," he said, as he towed her out of the hangar and into the remains of battle: drifting droplets of blood and hanging balls of smoke, wood splinters and tumbling scarves of bandage.

As he dragged her with bumps and jerks through the wooden ribs of the ship, Venera tried to keep her wits. She needed a sense of who was still alive, and where they were. The rocket racks were essentially iron cages, so it was easy to see their inhabitants. None of the senior officers were visible, only able airmen who stared at her listlessly or with fear. Was

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Chaison dead, then?

Dentius hauled her into the axle of the centrifuge, which had been spun up. Exhausted or wounded pirates lolled in hammocks at the rim of the wheel; she heard both moaning and laughter. "My cabin," she said to Dentius, pointing with her tied hands.

"Captain's cabin," he said. "You his woman?"

She shook her head. Chaison Fanning had appropriated Sembry's cabin, causing the *Rook's* captain to have to bunk elsewhere. "I was the admiral's wife," she admitted. "But he's dead and lost in the clouds now."

Venera had no doubt that Dentius would have asked the tortured men about her. There was no point in trying to deny her status.

Without comment Dentius shoved her into the cabin, which was a shambles of overturned chests and jumbled clothing. Most of the contents had been Sembry's of course; Chaison traveled light.

Her jewel box lay on the floor, its lid up, the fated bullet that had struck her jaw still on its velvet bed inside. The centrifuge's spin was making her nauseous, so Venera went to sit on the edge of the bed, making a show of straightening her clothes.

"So . . ." Dentius gnawed at one calloused knuckle. "Why'd you kill the rest of the bridgers?"

She shrugged. "They . . . objected to my tactics."

Dentius laughed. "Venera Fanning, that's your name, isn't it?"

"Aye," she said, lifting her chin. Her heart was hammering in her chest; raised though she was in the arts of deceit, Venera doubted she could keep her calm demeanor for long.

Dragging over a chair, Dentius sat down and clasped his hands in his lap. "So," he said in a horrible parody of politeness, "what brings you to our Winter, Venera Fanning?"

"Treasure," she said promptly. "Somewhat ironically . . . pirate treasure, to be exact."

Dentius shook his head. "If there were anything worth having out here, I'd have taken it and built a fleet to reconquer Aerie years ago. Nobody brings treasure into Winter. Anybody here who's got it, takes it somewhere sunny."

"I know," she said. "But that wasn't always the case. There've been times when convoys ran through Winter regularly, shipping goods between the principalities of Candesce and the outer nations. And during those periods, there was treasure to be had."

Dentius thought for a while. His face, which had appeared that of a brutal simpleton just minutes ago, relaxed by degrees into that of an weary, disappointed man. After a while he said, "I've heard the fairy tales. We all have. There was even a time when I believed in such things." With a faint smile he added, "It's Anetene, isn't it? You're talking about the—how would you put it?—'the fabled treasure of Anetene.'"

Venera frowned past his tired skepticism. "I was," she said. "We were on our way to the tourist station, because that's where the map is."

Dentius laughed. "You've got to be out of your mind," he said. "Anetene's a legend. Sure, he lived and he was a great pirate. The less intellectually endowed members of my crew swear by him. But the treasure's pure myth."

"Maybe," she said with a shrug. "But the map to it is real."

His lips curled in sly indulgence. "And what would an admiral of Slipstream be doing hunting pirate treasure in Winter?"

"As to that . . ." She looked away, making a faint moue. "Slipstream's finances are not in the greatest of shapes at the moment, if you get my meaning. The Pilot is not the cleverest of men when it comes to state funds."

"You've a deficit to pay off?" Dentius grinned.

"It's more like the Pilot has a deficit he's told the people about . . . and then there's the real deficit."

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"You're wanting to forestall a political scandal, I get that." Dentius shook his head. "The whole story is preposterous on the face of it, and you know it. So why are you trying to put this one over on me?"

"Because the treasure *is* real," she said. "But I realize that I can't convince you of that." Now she hesitated: how far could she push this man? If she played the next hand, he might kill her. But if she gave in to fear, he would have won; the bullet would have won. "There's another consideration," she said slowly. "I saw how you and your men fared during the battle. You have your own deficit now, Captain Dentius: you've just paid far more in men and ships than you've gotten back. Am I wrong in thinking that this is going to cause you some . . . political problems . . . of your own?"

Dentius's face flushed with anger. He stood up, knocking over the chair. "We're going to kill all of you for starters," he said. "Very bloody, very visible. My men will have their revenge."

"Yes, but will that be enough?" Venera allowed herself a small, ironic smile. "You know that the other captains won't be impressed. You lost ships, Dentius."

He didn't answer. "Killing us will be a good diversion," Venera continued. "But you need a better diversion. One that will last longer, until the memories of this debacle have faded. You've got to give your men *hope*, Captain Dentius, or else you may be out of a job."

"In other words," he said, "it hardly matters at this point whether the treasure of Arietene really exists . . ."

"As long as there's a map. Something to give the other captains." She nodded. "And there *is* a map."

Dentius leaned against the wall for a while; he was obviously not comfortable in gravity. Finally he nodded once, sharply. "Done. You show us to the map, you get to keep your life."

"And my virtue."

"Can't guarantee that. But let's say it's on the table." He grinned and turned to leave. "Cabin's yours. Anything else your grace requires?"

Life, not death, lay ahead—at least for now—so Venera decided to ask about the one thing that Dentius might be willing to indulge. "There is something . . ."

Dentius turned, surprised. Venera knelt down and retrieved her jewel box. She plucked out the bullet and held it up, next to her jaw.

"We have a history, this bullet and I," she said. "If I live, and if someday I gain my freedom again, I want to know where it came from."

He was obviously impressed. "Why?"

There was no pretense behind her smile now. "So that I can go there," she said, "and kill everyone connected to it."

A black wing lifted. Hayden blinked at a blurred jumble of shadows and silhouettes. Mumbles and tearing sounds came to his ears; someone was tugging at his shirt. He couldn't feel any surface under him, so he must be weightless. He was also very cold. And in the distance, the faintly annoying two-tone sound of the *Rook's* engines rumbled.

That meant something bad. "Hey!" he tried to shout. The word came out slurred and weak.

"He's awake." He recognized the voice behind the tense whisper. "Pardon us, Griffin, we're sacrificing the hem of your shirt to a better cause."

"Wha—" Admiral Fanning's voice had been dry, almost raspy. But why was he of all people here? Hayden shook his head, which filled him with an awful vertigo and a pounding pain that radiated forward from behind his left ear. *Don't throw up*, he beseeched himself. *Don't throw up. There's no gravity today.*

The gray blurs became a bit clearer. He was curled in fetal position in some cramped space defined by metal bars. There was no light source nearby; everything was shades of speckled gray with no color. Crammed into this unlikely place with him were three men and a boy. One of the men was Fanning. Anoth-

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er—he wasn't sure—might be Venera's manservant, Carrier.

Hayden's stomach did another flip, but not because of his own pain. The third man held Martor by a hand and a foot, stretching him out like a sheet about to be folded while Fanning tried to staunch a dark liquid welling from his flank. Martor's foot stuck out one side of the cage, his hand out the other.

"He's . . . stabbed?"

"Shot," muttered Fanning. "The bullet's still inside."

The sight had brought Hayden alert like a dash of cold water. "We need to dig it out," he said, focusing on making his uncooperative lips form the syllables.

"Really?" Yes, that was Carrier all right, his tone dripping sarcasm. "Keep your voice down," he added in a hiss.

Hayden wanted to ask why they were in this cage, but didn't want to hear any of the possible answers. The strange electric silence of the ship, the way these men flinched any time there was a noise in the distance . . . But overriding that curiosity was the need to know that Martor would be all right.

"Cut the man some slack," Fanning said quietly to Carrier. "He's concussed." He turned to Hayden. "The problem is that I can't reach the bullet with my fingers. And the only other thing we have is a couple of splinters of wood I pried off the hull." He held up two sharp spikes of wood. "If I go noodling around in your friend's abdomen with these, I'm going to puncture something for sure, and probably leave some splinters behind. That's bound to fester."

"Maybe you can help," said the man who was holding Martor like a sheet. Hayden recognized him as one of Fanning's staff. "We could heat the wood to sterilize it—without setting it on fire, of course. If we could reach *that*." He pointed.

Now Hayden realized where they were: crammed into the framework of a rocket rack, somewhere near the stern of the ship. The rack was mounted to the hull and surrounded by boxes that blocked the light. But where the staffer pointed, the corner of one crate was brightly silhouetted. Just around that corner was a lantern. Hayden held out his hand and felt the faint movement of air coming from its wind-up fan.

A cough sounded nearby and gruff voices spoke. The men in the cage froze, only their eyes darting in the direction of the sound. Seconds ticked by, and eventually they all sighed as one and relaxed from their positions.

"None of us can reach that lantern," said Fanning, as if nothing had happened. "But you're young and lanky. Care to try? We need these splinters heated, but not burned."

"Ah." He took them in one shaking hand. "Okay." Drops of Martor's blood were drifting past his nose, scented of iron. Hayden carefully ducked around them and pressed his shoulder to the bars of the cage. Once again in mid-distance he heard grating, accented voices: that was not the crew of the *Rook*. The pirates might see his hand groping around the corner of the crate—it was going to be brightly lit, after all—but he'd be damned if he was going to seize up like a busted engine every time one of them sneezed. He had to try his part to save Martor.

By straining until spots appeared in his eyes, he was able to get his hand around the corner of the crate. He knew the shape of the little lanterns intimately: they were like tiny bikes, open-ended cylinders with a wind-up fan at one end to move air past the lamp's wick. He pictured the device in his mind, and moved one of the splinters until he figured it was near the flame. He waited a moment, then brought it back.

The splinter was still cool. He tried again, shifting position slightly. Five tries and he put it right into the flame, making it catch light so that he had to quickly blow on it while Carrier cursed him for a fool. But he was getting the hang of it now.

A few minutes later he gingerly handed

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two hot lengths of wood to Fanning, who grunted in approval. Hayden felt proud of himself, happy for the implied praise, and then angry at himself for valuing Fanning's opinion.

Now that Fanning was at work, Hayden felt he could finally ask the questions that were burning in him. "Who shot him?" he asked Fanning's staff member. The man looked over Martor's arm at him with a bemused look on his face.

"We were going to ask you the same question," he said. "They threw you both in with us an hour after we lost the fight. I'd heard a shot . . . Were you outside the ship?"

Hayden nodded. "Clearing mines. . . . Now I remember. He hit me on the head because I refused to return to fight. You'd . . . already lost."

"Wisdom is often rewarded with a blow to the head," said the other. "My name is Travis. This is Carrier. You probably know the—uh, *Ensign* Fanning, here." Travis smiled ruefully. "You have the privilege of being stuck in the cage reserved for troublemakers. Fanning and I were caught sneaking outside the ship. Carrier made it all the way into the bridge of the enemy ship and killed six people before they subdued him. And apparently, you two attacked a fully-armed pirate ship with one bike and two pistols. We're a pretty worrisome lot, I guess."

"But we're alive," said Carrier in a flat voice. "Stupid of them."

"They don't know . . ." Fanning's voice was distracted. ". . . Which of us might be valuable."

"They don't know who he is," Travis whispered, jabbing a thumb at the admiral. "But they know there was an admiral on board. His ransom might be the only profit they see off this escapade."

"Thought I was him," said Carrier with the first trace of amusement he'd shown. "Why they didn't shoot me on the spot."

"Ah!" Fanning hunched over, gritting his teeth as he slowly inched his hands back. At last he drew a gleaming metal slug into the dim light. "That's it. Let's patch him up."

They'd each torn strips off their shirts. Hayden reached to hand some to Fanning, and his hand faltered. "Just a sec—" he said.

Then the black wing descended again over everything.

"I'm not sure that's such a good idea," said somebody. Hayden felt his body twitch once, then he was blinking around at a half-familiar vision of dimly lit bars and crowded bodies.

"Travis, I let you talk me out of surrendering myself when these criminals started torturing our men and now I feel ashamed of myself." Admiral Fanning sat on the air, knees up and his hands tightly gripping them. His breath misted in the cold air as he spoke.

Martor drifted, face pale and limbs akimbo, in the center of the cage.

"But it was to protect the details of the mission—"

"Hang the mission! These men are my responsibility. If I can spare just one of them the agonies we heard earlier, then I have to."

"Not if that ultimately kills them," murmured Carrier. "Quiet, someone's coming."

Hayden had been about to ask how Martor was. The sound of someone handskipping off the beams of the ship silenced him.

After a moment a lean, pale face appeared outside the cage. The pirate was young, almost grotesquely spindly, and dressed in layers of patched jackets, vests, and pantaloons. Keeping a safe distance, he shoved a couple of flasks in the general direction of the cage. "One's fer pissing, one's fer drinking," he said as they sailed over. "Don't get 'em mixed up."

Admiral Fanning cleared his throat. "Where are we going?" he asked in a calm tone.

"Voyeur's palace," said the pirate. "After we catch up to the rest of our fleet." He pushed off from the cage and began climbing away like a four-limbed spider.

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"What's the voyeur's palace?" whispered Travis.

"I think he meant the tourist station," said Fanning. "That's bad news. It means they found out what we're up to."

Travis sighed. "Great. So you're telling me the pirates know the purpose of our mission in Winter, while your senior staff still do not?"

Martor was breathing regularly, Hayden saw. He turned his attention to Fanning, who was looking chagrined.

"The revelation that we were looking for a famous treasure was to be kept from the men until we were actually there," said Fanning. "We felt it might . . . affect discipline . . . among the press-ganged members of the crew."

Carrier guffawed. "They might mutiny so they could set themselves up like kings, you mean."

"Yes, Mr. Carrier. That is what I mean."

Hayden stared from one man to the other. What was this about a treasure?

"But why undertake such an expedition now?" Travis shook his head. "We're at war with Mavery. There are indications that Falcon Formation is going to take advantage of the fact and stage an invasion. Why go running halfway around the world for gold? Unless . . ."

"Belay that thought, Travis," said Fanning. "We're doing this for the survival of Slipstream, and our present client nation." Hayden started at this mention of Aerie. "The fact is," Fanning continued, "our navy is no match for Falcon's. We need an edge, and since our Pilot has successfully alienated all our current neighbors, that edge can't be diplomatic. It has to be military."

"But a pirate's *treasure?*"

"Oh, forget the treasure, man. We'll divide that up between the men; I don't care about that. It's what's said to be kept with the treasure that interests me. Something that would be valueless to any of these men—or to pirates, for that matter."

"And that is. . . ?"

Fanning smiled enigmatically. "We sometimes forget, Travis, that we live in an artificial world—a world sustained by mechanisms so vast that we seldom realize that's what they are. And mechanisms built by Man have doors, and locks . . . I've said too much. Suffice it to say, if we find what we're looking for, Falcon Formation should be easy to handle."

Travis—and Hayden—waited. When nothing more was forthcoming, Travis said in annoyance, "Didn't you say 'hang the mission' a few minutes ago? Now you're being protective of it again."

"That's because our benefactor there," Fanning nodded in the direction the pirate had gone, "gave me an idea."

Hayden decided to reveal the fact that he was awake. "How's the kid?" he asked—though he also wanted to hear more about this treasure. His voice came out as a croak; he realized as he spoke how terribly thirsty and hungry he felt.

"The boy will recover," said Carrier. "What are you thinking, admiral?"

Fanning reached up to pull on the bars of the rocket rack where they were riveted to the hull. "This ship wasn't originally designed for Winter," he said. "It's a retrofit. Now, I once saw a rack like this pull free of the wall during a maneuver in Winter. It was due to frost-heaving in the planks."

"Oh?"

"If we inject water in between the boards, here and here . . ." The admiral pointed. "It may push the wood apart when it freezes."

Carrier looked disdainful of the idea, but Travis appeared to be giving it some thought. "Since the ship's been winterized, the chinks have been sealed with tar against bad air coming in," he pointed out. "The water will have nowhere to go."

"Exactly," said the admiral. "Now, I don't propose that we use our drinking water, here." He held up the other flask. "Everybody piss. We'll use that."

Hayden shook his head as Fanning unlaced his own codpiece and proceeded to demonstrate. Maybe he was hallucinating. That would explain why he seemed

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to have heard Admiral Fanning talking about a treasure hunt, and why that same admiral was now proposing that they piss in the walls.

"What are you suggesting?" he asked sarcastically. "Are we four going to take the ship back with the strength of our own arms?"

Fanning shook his head. "Of course not. We will scuttle the *Rook*. Can't allow Slipstream military hardware in the hands of the enemy."

"Ah . . . And how do we do that?"

"Got to get to the bridge. I suggest we find a porthole and crawl outside to the—" Fanning noticed Hayden vigorously shaking his head. "Why not?"

"Because when Winter pirates have a lot of prisoners, they hang the excess off the hull. So they'll have a man or two out there to keep watch."

All three men turned to look at him. "And how do you know that?" asked Carrier.

Hayden hesitated, but his last reserve of cunning was exhausted. "Because," he admitted, "I was press-ganged by pirates five years ago."

Now they just frankly stared. Finally Carrier shrugged and looked away. "Things begin to become clear. Knew you weren't what you seemed. Pirates planted you in the Fanning household?"

"No! Nothing like that." He'd done it now. Even if the pirates didn't kill him, Fanning would have him towed until he froze, or shot in front of the crew. There was just the faintest chance, if he told most of the truth—but not all of it—that he could avoid such a fate. "I . . . I eventually escaped and made my way back to Rush. And yes, I made up a cover story, that's true, I'd learned how to do that from a station infiltrator I worked for. But I wasn't working for anybody. I really did need a job."

Carrier raised one eyebrow. "Interesting," he said. "You actually expect us to believe that?"

"We'll deal with that question later," said Fanning. "Right now I want to know why you're familiar with how Winter pirates deal with their prisoners."

"Uh . . ." Hayden blinked. Fanning didn't care that he'd wormed his way into the service of his wife under false pretenses? Or was he really as focused on the here-and-now as he appeared? "Well, sir," he said, "I was brought on board the pirate ship *Wilson's Revenge*, somewhere in between being a slave and an apprentice. I couldn't leave; but I had the run of the ship."

Fanning waved a hand indifferently. "Press-ganged," he said. "Get to the bit about the prisoners."

Hayden took his turn at the flask and tried to organize his thoughts. "Ah. Um, being a pirate turned out to be the most unglamorous job you could imagine. It consisted of bullying fishing boats and birdcatchers and selling their tackle and nets at places like Warea. You could barely buy food, you had to hoard your ammunition, and beer was out of the question unless you brewed it yourself. Mostly it was just dark, dismal, and hopeless."

Fanning dug at the calking between the planks, at the spot where the frame of the rocket rack was mounted to the hull with bolts. Once he had a finger-sized hole, he jammed the neck of the now-full flask into it and squeezed. "Go on," he said.

"Once in all that time I spent with these men, we heard about a yacht that was trying to sneak through the cloud banks of the nations near Candesce. It was some young noble kid trying to reach his lover, who lived in a nearby nation the kid's nation was at war with. . . . You get the picture. My infiltrator boss had the word from one of his spies. So we went on the hunt and we found the yacht right where it was supposed to be. We . . . took it."

He didn't like being reminded of that incident, but now that he'd started talking about it, it seemed he couldn't stop. "Our ship was a modified birdcatcher, the same dimensions as the *Rook*, but mostly hold—empty space. Thirty crew, tops. The yacht had that many plus a ridiculous

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number of manservants and cooks and such for the noble kid. The hold was full of bikes, so my captain made most of the survivors ride outside."

Without realizing it, Hayden had hunched around himself and drifted into one corner of the cage. "Most of them froze to death in the first day," he murmured. "I know; I had to stand one watch."

Something had been festering in the back of Hayden's mind ever since the attack. Now he turned to Admiral Fanning. "Sir, how did the pirates know we were here? They must have amassed that fleet with some foreknowledge of its target."

Fanning mused. "Don't think I haven't been wracking my brains over that. As best as I can figure, somebody in Warea sent the word that we were there. They might have dispatched a bike in secret before we'd even reconnoitered the lake."

Or they might have intercepted my letter, Hayden admitted. But that wasn't necessary: Fanning was right. They'd recognized the origin of the seven ships as Slipstream, and could have sent out a courier immediately after the *Tormentor* had run into the lake.

He was distracted from this line of thought as the admiral called a huddle to discuss tactics. Hayden supplied his best guesses about where the guards would be stationed, and Travis provided a detailed description of the inside of the ship, including sight lines. Reaching the bridge undetected from the inside would be difficult, but it could be done.

While they talked, Hayden periodically checked on Martor. The boy was breathing more easily now, and though he remained pale and cold, he was at least alive. Hayden wrapped his own jacket around Martor's feet to help keep him warm; out of the corner of his eye he saw Fanning nod approvingly as he did so.

That fanned the smoldering spark of his anger. Who was this murderer to deign to approve of his decency?

Just then a sharp crack sounded from the hull. The rocket rack quivered and all four men turned to stare at the planking. A long splinter had popped up and the crack ran right under the bolted frame. "I don't believe it," whispered Fanning. "The damned thing worked."

"I'll never doubt you again," said Carrier. He almost smiled—but Fanning turned and looked down his nose at the man.

"Your confidence is not required, *Mister* Carrier," he said. "Now help me lever this thing aside. We need the youngest and nimblest of our party to slide under here."

They braced their feet against the hull and hauled on the bars of the rack. The bolt pulled free with a groan and a space opened between the bars and the hull. Hayden didn't feel particularly nimble at the moment, with his head pounding like a malfunctioning sun, but he eagerly wriggled his way into the opening.

He was through up to his hips and already thinking about how to deal with the guards he knew were lurking around these crates, when the sound of the ship changed. The engines changed pitch, and the sound of a ringing bell echoed through the space. Moments later the engines cut out entirely.

"Back, get back in!" Three sets of hands dragged him back under the pressing rust of the rack. Scratched and breathless, Hayden pressed himself against the hull as three pirates with pistols in their hands rounded the crates.

"Here's the catch of the day," said one with a laugh. "You gentlemen have the privilege of witnessing a grand display of fireworks to celebrate our reunion with the rest of our fleet.

"Well, okay," he admitted with an ironic wink at his companions. "You won't really be witnessing the fireworks. You're gonna *be* the fireworks."

They all laughed, and he came to unwind the chains holding the rack closed. "Get out!" he commanded.

"It's execution time." ■

To be continued!

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THE REFERENCE LIBRARY Tom Easton

Old Twentieth, Joe Haldeman, Ace, $24.95, 257 pp. (ISBN: 0-441-01285-X).

The Hidden Family, Charles Stross, Tor, $24.95, 303 pp. (ISBN: 0-765-31347-2).

Night Train to Rigel, Timothy Zahn, Tor, $24.95, 351 pp. (ISBN: 0-765-30716-2).

Rocket Science, Jay Lake, Fairwood Press, $17.95, 223 pp. (ISBN: 0-9746573-6-0).

Surviving Antarctica: Reality TV 2083, Andrea White, Eos, $15.99, 327 pp. (ISBN: 0-06-055454-1).

Farscape Forever: Sex, Drugs, and Killer Muppets, Glen Yeffeth, ed., BenBella Books, $17.95, 218 pp. (ISBN: 1-932100-61-X).

Collapse: How Societies Choose to Fail or Succeed, Jared Diamond, Viking, $29.95, 576 + xvi pp. (ISBN: 0-670-03337-5).

Over the years, Joe Haldeman has established himself as different from many writers. He has done a trilogy or two, and he has been known to add a sequel, but where so many others commit trilogies and series galore, his tendency is to do something new each time out. His latest, **Old Twentieth**, is as new and fresh as anything he's ever done.

The premise is fairly straightforward: Centuries hence, humans are immortal, a probe has identified a life-bearing world, and the starship-cluster *Ad Astra* is on the way, bearing 800 immortal colonists on the centuries-long voyage. There's enough to do to keep them busy most of the time, but they have a virtual-reality time machine that lets them spend time in chosen segments of the twentieth century. The book's opening in 1915—bloody nasty war and death at Gallipoli—sets the pattern: it's those bloody moments that seem to draw everyone's attention. No one ever seems to want to pass time visiting Disney World or Coney Island, working as a stock broker, running a roulette wheel, or going fishing.

Why? The protagonist, Jacob Brewer, is a virtual reality engineer, dedicated to maintaining and tweaking and updating the time machine. He spends a little time thinking about that question, and his answer lies in history. The immortality process was initially for the rich only, and the rest of the world was so resentful that there was global civil war, which ended only when the immortals released an agent that dropped all non-immortals dead in their tracks. Every immortal thus has as a monument in memory the bloodiest massacre in all of human history. Every one of them also shares in the guilt, and the twentieth century—known in its own time as the bloodiest in history—seems a bit idyllic, a hotbed of nostalgia, an opportunity for expiation of guilt through death—albeit merely virtual death. The cover blurb says people "are addicted to exploring the life-to-death arc that defined a lifetime so long ago," but there is a good deal more to it than that.

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The dynamic strikes me as very understandable, very likely. But of course, the characters are not merely bundles of guilt-ridden obsessions. Some avoid the time machine. Jacob has a wife, friends, and other memories. But everything else takes second place when someone dies while in the time machine. That isn't supposed to be possible! More deaths follow. And then the news from Earth reveals that people are dying there too, some in virtuality, some not, and all of them among the first generation of immortals.

What's going on? It's a puzzle, but Jacob has to wrestle with the question of whether the machine should be closed down. That's when the machine itself shows up in the virtual world and says to Jake, "We have to talk." It appears to have become sentient, and though it insists that it is not responsible for the deaths, Jacob is not confident that he can trust the machine. In fact, people start wondering whether they can even trust it to continue its more mundane functions, such as maintaining life support. Maybe they should all just take the suspended-animation drug known as Nepenthe, despite its mortality rate, and wait out the journey.

Haldeman drops a few clues, but they don't really become clear till the final resolution, about which I will say only that nothing is what it seems. And if nothing is what it seems, perhaps I should try another interpretation of his characters' obsession with the Old Twentieth Century. Is it rooted in guilt as I suggested? A search for expiation? Or perhaps Haldeman is saying no more than "All is relative." The twentieth century, as nasty as it was, was hardly as nasty as it can get, or perhaps Gallipoli, Dresden, the World War I trenches, the *Titanic*, a stroke in virtuality, and every such event was maximally nasty, for death is death and death is final. Don't ever lose sight of that, and yes, do everything you can to prevent it and to preserve existence, the essence.

The ending, about which I will reveal nothing, can even be taken to support that thought.

Have I teased you enough? Then go buy the book. I recommend it heartily.

Last April, I reviewed Charles Stross's *The Family Trade*, in which ace investigative reporter Miriam Beckstein stumbled upon a massive money-laundering scheme, was given an antique locket containing a strange knotwork pattern by her adoptive mother, and was promptly snatched into a parallel world (World 2) where she turned out to be a long-lost heiress to the leadership of a transdimensional Mafia based in the realm of Gruinmarkt (northeastern America). As she dodged assassination attempts, she decided the Family's business model—not to mention its attitude toward women—had serious shortcomings and she was just the one to set things straight and on their ear all at once.

One of her would-be assassins turns out to carry a pattern like the one she uses to go between Gruinmarkt and Boston. But it's not quite the same. When she tries it out, she winds up in World 3, a Boston ruled by England and just getting into the twentieth century. Aha, she thinks, instead of lugging material valuables (the Family is big on drugs), she can move immaterial ones—ideas and old patents from our world—and stimulate the growth of industries and economies. Make it work, and her place in the Family will be secure and the Family will be richer and more powerful than ever.

But the plotters and assassins remain, and not all are from the Family she knows. The title of **The Hidden Family** suggests the secret, but before the answer can become explicit, Miriam must find herself financing pro-democracy radicals; encounter secret police; discover that when Family women visit World 1 to help her out, they find that women can have things a lot better—not just in

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terms of hot water and central heating!—and decide that they are definitely on her side; and learn that Roland, her Family boyfriend, is not quite as noble as he is yummy. By the end, some of the plotters are unmasked, a villain has vanished (surely to surface again), old secrets are revealed, and Miriam's position is secure in three worlds.

Since vanished villains have a way of resurfacing, the topic of the hidden family is not exhausted, and World 3 industrialists are beginning to hit on Miriam, you can bet your booties the series is not over. It should also be very successful—perhaps even successful enough to give Roger Zelazny's Amber and Philip Jose Farmer's World of Tiers a run for their money.

Yes, Stross is that good.

Tim Zahn's **Night Train to Rigel** is SF adventure in the classic mode. When hero Frank Compton steps out of a hotel, an apparent vagrant accosts him and drops dead, full of holes. In his pocket is a Class A ticket on the interstellar passenger train known as the Quadrail. So Frank takes the ticket and boards the train.

Yup. Train. It's run by the robot-like Spiders, it has four rails, and it runs through something like hyperspace to link the stars. And it isn't long before Frank has picked up a companion named Bayta, learned from the Spiders that someone is apparently threatening to destroy the Quadrail, and started letting people hand him clues and lead him off toward Modhri, source of a popular and expensive coral which Bayta warns him not to touch.

What's going on? Frank doesn't have any idea, but he's willing to let the bad guys think he does. That's all it takes in this sort of tale. If villains had the sense to keep their heads down, Charteris, Hammett, Macdonald, Fleming, and Hitchcock (among others) would have been out of work. But they don't, especially in fiction, and Frank winds up being led straight to the den of the puppetmasters whose nefarious aim is to conquer the galaxy.

If the reader is in any doubt that Zahn is paying homage to a long line of predecessors, bear in mind that most of the tale takes place on a train. In the spirit of those predecessors, there is the obligatory race across the top of the cars to reach the engine and avert disaster. Of course, since this tale is SF, Zahn has to toss in a nifty variation. Watch for it, and when you spot it, ask yourself how the heck the train manages not to tear itself to pieces.

Have fun!

For a taste of good, old-fashioned SF fun, you could do much worse than pick up a copy of Jay Lake's **Rocket Science**. The time is just after the close of World War II. Vernon Dunham, made less than able-bodied by polio, stayed home, became an aircraft engineer, and earned a pilot's license. Vern's childhood friend Floyd Bellamy went off to Europe and returned full of stories that strike Vern as a bit too embroidered. But what the heck—Floyd carried Vern on his back when they were kids, he's a convivial fellow, and when Floyd asks Vern to borrow his dad's truck and meet him at the depot, Vern obliges.

When the train pulls in, there's an enormous crate for the truck, along with a Nazi halftrack. They get everything back to a barn at Floyd's folks' place, open the crate, and by golly, there is the durnedest airplane, sleek and marvelous, and Vern wonders who the heck could possibly have made it. The Germans? So Floyd says, but Vern finds some paperwork in the halftrack and it looks like the Germans dug it out of the Arctic ice. That's when the paperwork disappears, Vern's alcoholic dad gets beaten, military intelligence shows up, Nazi secret agents start crawling out of the woodwork, and the marvelous plane starts talking in Vern's ear.

There's no real mystery about where

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the plane came from. But who's beating up dads, stealing papers, and trying to get their paws on the plane? Besides Vern and the plane, there are at least four teams in play, and Vern's going to have to move pretty fast to keep from getting scrunched in the scrimmage. But he doesn't let his bad leg stop him, and in the end . . .

You'll have fun finding out what should end that last sentence. I did.

Andrea White's debut novel, **Surviving Antarctica: Reality TV 2083**, is not marked (except by price) as for the YA market, but it is not at all suitable for anything more mature—or even *that* mature. The premise is a future America so impoverished that schools have been closed, education is a matter of watching endless *Historical Survivor*, *Dialing for Dollars*, and *Tele-Novelas* shows on TV, federal funding for research is kaput, ordinary folks live in shanties, and kids who wish to go on to high school and college must win the Toss—a single dice throw. The Toss is supposed to be fair to all, but its fairness is more akin to that of communism than to that we are used to, which says that no matter what dairy the milk comes from, if it has any cream, that cream will rise to the top.

The kids know it too, especially the ones with any cream, and it galls them something awful to see the smarmy Secretary of Entertainment, who won her Toss fair and square and does not hesitate to remind everyone of how fair the system is, presiding over their own shafting. Here's Polly, Billy, Robert, Andrew, and Grace, fourteen years old, thoroughly bummed, and when they see the pitch for *Antarctic Historical Survivor*, in which five lucky (!) fourteen-year-olds will get to reenact the doomed Scott expedition to the South Pole, they apply. They get picked, too.

Sound like fun? There ought to be a camera crew handy in case of trouble? Nope. The cameras are installed in their own eyeballs, not that they know it. And the Secretary of Entertainment has a script with a string of programmed catastrophes. These kids will be lucky to get out of this alive!

They have talents, though, and over time the group comes together and learns to work together and value each other's contributions. It looks like they just might make it.

Except for sharks, crevasses, and a blizzard. Fortunately, the night production crew can quite illicitly do a bit of coaching. Equally fortunately, all of America is watching and concluding that there is something drastically wrong with a system that permits such awful things to happen in the name of entertainment.

That doesn't sound like too bad a story, does it? But White fails to give Antarctica a single penguin, skua, or other bird, there's one seal, encountered rather far from the coast, the politics are a cartoon, and the kids don't show a single trace of libido.

They're fourteen, for Pete's sake. And they act like eight. White's strong suit is not verisimilitude, and that's enough for me to say the book isn't really worth recommending even for younger readers.

About a year ago (as I type this), I was invited to write for one of BenBella Books' "Smart Pop" titles. The editor, Glenn Yeffeth, gave me a choice and I picked **Farscape Forever: Sex, Drugs, and Killer Muppets**. My essay deals with how the heck you get a living starship such as Moya. There are twenty more as well. Jeanne Cavelos ("Down the Wormhole") holds forth on plot complications and says that *Farscape* trusted "us to use our brains and hold on tight." Rick Whitten-Klaw ("Flatulence, Food and Fornication") praises everyday realism. Kelley Walters, spiritualist ("Journey to the Feminine"), finds the goddess religion in the show. Jean Rabe ("A Hitchhiking Pilot") considers Pilot as parasite. Josepha Sherman roots "Zhaan: Plant, Priest, Archetype" in myth. Jody Lynn Nye ("My

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Imaginary Friend") analyzes the personality chip Scorpius stuck in Crichton's head. And so on.

BenBella specializes in "thoughtful, creative, intelligent, and unusual" books on science fiction and popular culture. Toward this end, it recruits people in the field it suspects might have something interesting to say. Judging from this book, it achieves its goal. The unifying theme is the late, lamented *Farscape* show; around that theme Yeffeth has drawn together a great deal of "thoughtful, creative, intelligent" and even unusual commentary. The result will delight the show's many fans, and it may help to explain to nonfans why the show is so sorely missed.

Face it: the worlds of most TV shows are not nearly rich enough to spawn a book's worth of commentary!

Jared Diamond won the Pulitzer Prize for his last book, *Guns, Germs, and Steel*. The caliber of his latest popular science book, **Collapse: How Societies Choose to Fail or Succeed**, should therefore be no surprise. The only real question is whether you should read it or not.

If you want to know what's going on in the world, how it all got that way, and where it all may be going, the answer is yes. Diamond's concern is the sustainability of modern civilization, which he addresses by surveying a number of not-so-modern civilizations, some of which fell apart (largely but not entirely due to resource exhaustion) within centuries of their founding. One classic case is Easter Island, whose residents cut down the trees they needed to make the canoes they needed to catch fish—or to leave the island—and soon thereafter suffered war, starvation, cannibalism, and population crash. Another is the Greenland Norse, who clung to their identity as Europeans so tightly that they could not notice that the Inuit had the hang of surviving when the climate turned icy. Just as classic, however, are people like the New Guinea highlanders, who maintained a healthy and populous civilization for thousands of years. Why? Diamond calls attention to a number of factors, some of which have to do with the nature of the environment: for instance, an area subject to periodic prolonged droughts (such as the American Southwest) cannot maintain indefinitely a society grown up—like the Anasazi—in the good times between droughts. Thick, rich soil helps, as does being downwind from volcanoes (volcanic ash renews soil nutrients) or continents (so does windblown dust). Climate change has a disproportionate effect on lands that are marginal for agriculture, as was Greenland even before it turned colder. Some factors are more social. Hostile neighbors are no help at all, and trade networks can have a protective effect (and of course Easter Island is famous for its isolation).

A final set of factors, which gave Diamond his title, involves the response of a society and its leaders to any problems that arise. On tiny, isolated Tikopia Island in the South Pacific, the Polynesian inhabitants noticed around 1600 that highly valued pigs were destructive and deliberately chose to destroy them all. Given such a pragmatic attitude, it is no surprise that the Tikopians also practiced explicit population control through contraception and other methods. As a result, they have maintained a sustainable civilization for about 3,000 years.

What do the success stories have in common? Good fortune is part of it, but more to the point is the willingness to undertake long-term planning and the ability to reevaluate traditional values (such as "Pigs are good") and discard those that no longer hold. Both are difficult, the latter is downright painful, and a society that does both has no guarantee of survival. But these two factors are essential.

Are the parallels between the ancient and modern worlds close enough to of-

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fer lessons to the modern world? To convince us that long-term thinking and the chucking of inappropriate values are good ideas? In a word, yes. Diamond is eloquent and persuasive. He is also careful not to seem to be saying that we are doomed. Indeed, he says he is cautiously optimistic, for though the modern world is guilty of all the stupidities of the past, and then some, it is also more aware of the problems and what must be done about them. The question is whether we will make the hard decisions and do what must be done.

It is comforting to reflect on the way some trends—such as population—are looking better. But others are not. Fisheries are crashing around the world, ground water is vanishing, surface water is inadequate to human demand, climate is warming, soils are thinning, seas are rising, and oil may have hit its Hubbert Peak (after which less comes out of the ground every year) by the time you read this. Do we have time to do what must be done? Maybe. Diamond says "we have the opportunity to learn from the mistakes of distant peoples and past peoples. . . . My hope in writing this book has been that enough people will choose to profit from that opportunity to make a difference." ■

Continued from p. 7

Writing is how writers react—so it is right and proper that when writers think they see disturbing trends, they write about the perceived dangers, where they might lead, and what might be done about them. They've been doing this all along, here and elsewhere, and will continue to do so. There's nothing new in this; I've already quoted Campbell above, and you can easily find plenty of other examples in his editorials (e.g., "Hyperdemocracy" and "Infracaniphilia"); those of his successor, Ben Bova (e.g., "Courage"); and the fiction they both published by many writers. Isaac Asimov's first story here, "Trends" (July 1939), might surprise you with both its "political" emphasis and its current timeliness.

Our main goal all along has been, and will continue to be, to provide consistently and highly entertaining stories. But an important secondary goal always has been, and will continue to be, to provoke thought about anything that needs or deserves thinking about. An important subset of that is pointing out potentially dangerous trends and speculating on where they might lead and what might be done about them. If this bothers you—if you ever think one "side" of a controversy is getting too much exposure—I invite you to write your own rebuttal. Write a story if you can, or a letter if a story seems too daunting. We don't aim to give equal time to all possible viewpoints *per se*, regardless of how tenable or well argued they are; but we're certainly interested in presenting a range of viewpoints and we're always glad to get an unusual one for which you can make a cogent case. If something somebody says here offends you, be patient; it probably won't be long before the shoe is on another foot. Eventually, you may be sure, somebody here will offend *anybody*, because trying ideas on for size and conducting a vigorous dialog about them is our best chance of steering a course toward a future we'll like. ■

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BRASS TACKS

Dear Dr. Schmidt:

I just finished reading your June 2005 editorial on "Zero-Pollution Solutions." In the late 1970s or early 1980s when I was still teaching geography, I remember a proposal to extract energy from the Gulf Stream where it passed between Florida and Cuba. Nothing came of it, possibly because of technical challenges. What concerned me was the possibility of extracting a significant amount of energy so that the Gulf Stream would no longer have sufficient energy to continue north in the Atlantic and remain the North Atlantic Drift current that moderates the temperature in Western Europe. Changes in the North Atlantic Drift have occurred in the geologic past and will occur in the future, but to force such a change over a very short period of time would result in worldwide changes with devastating effects on the economies of Western Europe. Again, unexpected effects from apparent good intentions. Off hand, extracting energy from sunlight appears to have the least negative environmental effects, but there may be problems with that that I don't anticipate. I've seen the experimental wind farm on the western end of Prince Edward Island and am concerned about large wind farms now being developed in California. There is a proposal to build a similar wind farm offshore of Boston Harbor but so far there has been considerable opposition to it, primarily by those concerned about the local bird population. My concerns are more about climatic changes as more and more of these wind farms are developed around the globe. As clearly shown by our weather forecasting brethren, understanding of the wind patterns of the globe is very complex and until adequate data can be acquired as to how these wind patterns interrelate, our forecasts are really no better than those made 30 or 40 years ago. Note how often several computer models are used, illustrating how unsure meteorologists are as to what data are necessary to improve forecasting skills. We can afford to experiment in small areas with different methods of extracting energy, but we really need to know more than we do about the interrelationships of barometric pressure with the resultant winds before going large scale with such technology. Likewise the interrelationships of the winds with the ocean currents and differences in water temperature. There still are large economies of energy usage to be obtained by conservation, which currently (sic) seems of little interest to the world.

Loren Gould, Prof. Emeritus
Hardwick, MA

Sir,

Sorry to have left the magazine on the dining room table for the two days since delivery, but it is final examination grading time and that always fills me with a strong desire for intake of bourbon, not literature. Ah, well, having no spirituous liquors in the house, the heady delight of your editorial, followed by BT letters and then the stories, will retrieve my eyebrows from the overhead.

I am writing, just this short note, to

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mention that Eric Lipps' BT letter (July/August) on John Cramer's article, concerning "phantom energy" <clichés> rang a bell, struck a chord, etc. </clichés> with past SF reading. It reminded me of my old friend Bob Heinlein's "Waldo/Magic, Inc." stories from the 1940s, wherein the spoiled myasthenic youngster hooked up with the Pennsylvania "Dutch" hex doctor who had the path to the "other world" where this mysterious energy came from well in hand. I could envision the wriggling fingers of the "deKalbs" even as I sympathized with Mr. Lipps' gentle jab at John.

Dwight Scott Miller
In the woods near Hearne, Texas

Dr. Schmidt,

I generally agree with your editorial "Inevitable Clichés" (*Analog*, July/August 2005), but there is one point on which I must take issue. There are significant questions about clones, both per se and in their relation to society.

The most important issue is that behavior, custom, law, and politics are not always driven by objective consideration. If you look at the current debate about abortion, it will be clear how fragile the separation of Church and State. I see no reason why an author wouldn't extrapolate a future in which those holding that clones are soulless would pass laws reflecting their beliefs. I see no reason why such stories, if well written, would not be appropriate in *Analog*.

A secondary consideration is the statement that what the press describes as clones are, in fact, not clones, but simply the closest that we can come with current biotechnology. The experiments that have been conducted to date have involved denucleation of an ovum and insertion of a nucleus from a somatic cell. The resulting ovum is a hybrid, containing cytoplasmic DNA from one source and nuclear DNA from another. The difference might be too subtle to matter, but I'm not aware of any evidence either way, and superficially it seems like a reasonable issue for an author to explore.

Shmuel (Seymour J.) Metz
Annandale, VA

Dear Stanley Schmidt:

Thank you so much for "The Time Traveler's Wife" and "In the Loop."

It's so nice to read about people who are nice, and trying to do the right thing, so that life will be better for those around them.

I was so overwhelmed with emotion on reading those two stories that I burst into tears.

I have just finished writing an invited article entitled "Difficult Decisions: Ethics in Research" to be published in a scientific journal, and I suppose I may be a little overwrought on the topic of the need to make the world a better place as best we can. But still, it was just so nice.

Thank you for caring about what happens.

Manuella Adrian

Dear Stan,

In the July/August 2005 issue, Wil McCarthy's Science Fact article on his "Mission to Utah" at the Mars Society Desert Research Station mentioned the minimal bathing resulting from limited water and limited energy to heat water. He claimed that humans have a natural scent, a natural coating of oils and bacteria adapted specifically for the purpose of protecting our skin, and that "after four or five days it stops being gross and starts feeling sort of, well, natural." He also said that taking a shower after he got home made his skin feel "dry and itchy for hours."

McCarthy may be right about a protective effect from natural oils and bacteria. Ernie Pyle, in "Here Is Your War" (ISBN 0-88029-405-1), reported going without baths for five and six weeks at a time as a war correspondent in Africa in World War II. Pyle said, on pages 292-

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293, "I discovered I was a guy who could take baths or leave them alone. Certainly my unsanitary condition didn't undermine my health, for I had never felt better than during those long dirty periods.

"We found out one thing about baths at the front—if we didn't bathe for a long time the fleas didn't bother us. Apparently we either built up a protective coating that they couldn't get through or else we became too revolting even for fleas. Whatever the reason, I knew of rash people who took an occasional bath and were immediately set upon by fleas, while we filthy characters sailed along blissful and unbitten."

My personal experience does not match either of theirs. I went three weeks without a bath once, and it kept right on feeling gross to me. I agree with McCarthy's wife—if you don't take baths, you reek.

This is how it happened: I took a five-week backpacking trip in the Wyoming Rockies with the National Outdoor Leadership School. For most of the trip, we were at high altitudes. It was only June, and the lakes up there were still frozen over. Nobody was tough enough to chop a hole in the ice and jump in, so we had washcloth "baths" for three weeks while carrying heavy packs over the Continental Divide. When our itinerary led us to camp at a lake only partly frozen over, everybody took baths. Even though it was literally ice water, it was worth it to be clean. When we got out of the mountains, we visited a hot springs resort, where I had a hot, soapy shower followed by a long hot soak. My skin did not itch in the slightest. It felt great to be clean.

I wonder if the difference in effects of not bathing was due to a difference in production of skin oils. Some people have dry facial skin while others have acne, so why shouldn't there be a range for oil production on the rest of the body? A person on the low end of the range might be comfortable not bathing for weeks, while somebody higher up the scale might not. I had acne at the time, which argues that my skin oil production was in high gear.

Ann Knudson
Bismarck, ND ■

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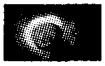

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UPCOMING EVENTS Anthony Lewis

December is a slow time of the year for science fiction conventions.

25–27 November 2005
Darkover Grand Council 27 (Marion Zimmer Bradley-oriented conference) at Holiday Inn Timonium, Timonium MD. Guest of Honor: C.S. Friedman. Special Guest: Katherine Kurtz. Musical Guest of Honor: Clam Chowder. Registration: $40 until 1 November 2005; $45 thereafter (checks to Armida Council). Info: www.darkovercon.com; Box 7203, Silver Spring MD 20907.

25–27 November 2005
LOSCON 32 (Los Angeles area SF conference) at Los Angeles CA. Guest of Honor: Stephen Brust. Artist Guest of Honor: Rowena Morrill. Fan Guest of Honor: Bruce Farr. Registration: $30 (checks to Loscon 32). Info: info@LASFS.org; www.loscon.org; Loscon 32, c/o Los Angeles Science Fantasy Society, 11513 Burbank Blvd, North Hollywood CA 91601.

2–4 December 2005
SMOFCON 23 (SF conference runners conference) at Red Lion Convention Center, Portland OR. Info: smofconpdx@gmail.com; www.osfic.org/smofcon; OSFCI, Box 5703, Portland OR 97228-5703.

23–27 August 2006
L.A.CON IV (64th World Science Fiction Convention) at Hilton Anaheim, Anaheim Marriott, Anaheim Convention Center, Anaheim CA. Guest of Honor: Connie Willis. Artist Guest of Honor: James Gurney. Fan Guest of Honor: Howard DeVore. Special Guest: Frankie Thomas (Tom Corbett, Space Cadet). Registration: $150/C$195/€125/£72 until 14 September 2005. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. Info: www.laconiv.org; info@laconiv.org. L.A.con IV, c/o S.C.I.F.I., Inc., Box 8442, Van Nuys CA 91409. International Agents: Canada: Lloyd & Yvonne Penney, 1706-24 Eva Road, Etobicoke, ON M9C 2B2, Canada (Canadian cheques to Lloyd Penney). UK: John Harold, Robbie Bourget, 8 Warren Close, Langley Slough, Berkshire SL3 7UA, UK (UK/Euro cheques to John Harold).

Attending a convention? When calling conventions for information, do not call collect and do not call too late in the evening. It is best to include a S.A.S.E. when requesting information; include an International Reply Coupon if the convention is in a different country.

Running a convention? If your convention has a telephone number, fax number, e-mail address, or web page URL, please let us know so that we can publish this information. We must have your information in hand SIX months before the date of your convention.■

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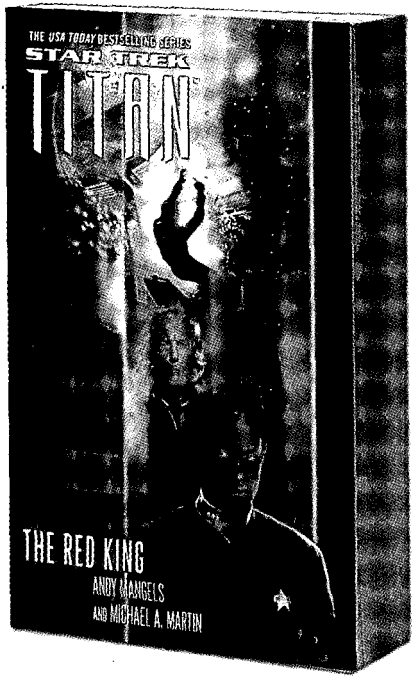

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